



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE NORTH AMERICAN SPECIES OF CURVIPES

By ROBERT H. WOLCOTT

WITH FIVE PLATES

I. INTRODUCTION

The members of the genus *Curvipes* are distinguished from those of all other genera of water-mites by their strength, activity, and ferocity, other species of water-mites, small insects, larvae, various species of crustacea, and, in fact, almost any aquatic form which they can master falling a victim to their rapacity, and many of these being superior in size to their captors.

The species are readily identified by the possession of structural characters which, though not subject to wide variation, are easily sufficient to distinguish the different species one from the other. These are the possession of palpi the fourth segment of which bears two or more papillae, and which are terminated by three or four small claws; of epimera collected into four groups of two each; of a genital area immediately behind the last epimeron, which presents a median area flanked by numerous acetabula set free in the body wall or imbedded in chitinous plates; of legs bearing swimming-hairs and ending in retractile claws; and, in the male, of modified segments of the two last pairs of legs—the sixth in the case of the third pair, the fourth of the other, this modification being of a characteristic type.

The species agree very closely in structure, and it is well to give a general description of the characters of the genus, leaving to be included in the descriptions of the individual species only such details as are subject to specific variation and distinguish each particular form.

The body is elliptical or oval in form, moderately compressed or highly arched, the anterior margin more or less emarginate between the eyes, and in some forms with posterior lateral emargina-

tions. There is also frequently a dorsal constriction behind the eyes. The surface is usually marked with fine lines, and in some forms there are evidences of the deposition of chitin in the subcutaneous tissue. In front of the eyes and below them are usually found two bristles varying in length and form and termed, from their position, "antenniform bristles."

The maxillary shield, seen from beneath and forming the floor of the so-called "capitulum," is of the typical shield shape with a well-developed ancoral process extending backward between the anterior pair of epimera. The mandibles are flat and four-sided with the ventro-posterior angle more or less produced, while at the anterior end is articulated a claw, which is curved, triangular in section, and tapers to a point. On the inner surface of this claw is a patch of what usually appears like fine, parallel striae, but which fortunate views resolve into a comb of fine hairs (pl. XXIX, fig. 6), and along the lateral edge of the flexor or concave surface is a series of fine serrations.

The palpi are usually compressed, especially the fourth segment, the flexor margin of which is provided with two or more papillae, together with a spur at the distal end. There is usually a small spine at the tip of the extensor margin of the first segment, and on the second three spines in a row on the inner surface and two on the outer, one in the middle and the other at the distal end. The third segment has two spines on the inner surface and one on the outer, while the last segment bears at the tip three or four small, more or less curved, claws. The second segment is the thickest, the third and first about equal in this regard, the fourth next, and the distal the narrowest, while in length the fourth usually is greatest, and then in order the second, fifth, third, and first.

The epimera are always collected into four masses, the first and second and third and fourth of each side being in close apposition. In the male the space between the second and third is usually narrow and that between the two posterior of opposite sides narrow or quite obliterated, while in the female the spaces separating the four masses are all of them relatively wide. The posterior margin of the last epimeron is produced caudad, forming a sharply pointed angle within which the margin of this epimeron is usually more or less concave, while laterad of it the margin runs almost straight to the articulation of the fourth leg.

The legs in the female exhibit an increasing length and also an increasing breadth from first to last, while the individual segments decrease gradually in thickness from the base outward. The last segment of the first three pairs of legs in this sex is more or less club-shaped and bears at the outer end two claws which are capable of being retracted into a cleft on the extensor side. These show a long pointed tip between which and the base is usually a second, blunt, more or less flattened and curved tip, and at the base a broad, flat expansion. Beneath this claw at the tip of the segment on the flexor side is often a short straight spine, while on the middle of either margin of the cleft that receives the claw is a pair of fine hairs, near the outer end of these margins another pair, and at the inner end of the cleft still another. The legs are provided with a double row of weak spines along the extensor surface and long, heavy spines on the flexor surface, which increase in number from the first to the fifth segment, and on the basal segments tend to be grouped at the tip, on the third in the middle also, and on the fourth and fifth scattered along the margin in a double row. There is also a greater or lesser number of long, slender hairs on the posterior side of the fourth and fifth, and sometimes the third segment of the anterior pairs of legs, while in the posterior one or two pairs these are gathered into a close oblique row at the tip, become of value in progression, and may be termed "swimming-hairs." The sixth segment of the last pair of legs in this sex is usually long, slender, and straight and bears claws which are miniatures of those on the anterior legs.

In the male the first two pairs of legs are similar to those in the female, and the third also, except that the fifth segment is usually elongated and devoid of long, scattered hairs or swimming-hairs, and the last segment is modified in a characteristic manner to serve as a sperm-carrier. This modification consists in a shortening of the whole segment and more or less of a thickening of the tip, which is rather squarely truncate. The cleft which receives the claws is carried around on to the end of the segment, but retains the hairs along its margin described for the female. The claws are highly and variously modified in the different species, the two becoming frequently unlike. It is to be noted that all the elements present at the tip of the corresponding segment of the female are here present but in a modified form, no new structures being added.

In the case of the fourth leg of the male the four basal joints are usually thicker than the outer two, and the fourth is modified to form an organ for grasping the anterior legs of the female in copulation. This modification consists in a deep excavation on the posterior side, both proximad and distad of which the segment is often dilated. The anterior side is gently convex and along it are a few weak spines, while on the flexor surface there are the usual long, stout spines. Proximad of the excavation on the posterior surface are numerous stout, blunt, more or less curved, saber-shaped spines, varying in length, and a few longer, pointed spines. Within the excavation are a few spines, while distad of it is a greater or less number of short, stout, blunt ones, and a varying number of long, slender swimming-hairs. Owing to the fact that the last pair of legs is directed backward, the posterior surface, on which is the excavation, is next to the body, while the anterior surface is on the outside.

The genital opening is close behind the last pair of epimera, and the chitinous plates about that of the male are frequently fused with the inner end of the last epimeron. In this sex the opening is generally small and is either at the bottom of a depression which serves as a seminal receptacle or opens into a more or less well-developed seminal pouch. This median portion is usually flanked by chitinous plates varying in form and bearing a variable number of acetabula. The genital area of the female exhibits a long genital cleft in the median line guarded by two flaps, which together form an elliptical area, and which in turn are flanked by chitinous plates bearing a corresponding number of acetabula. In a small number of species these acetabula, in one or both sexes, are imbedded free in the wall of the body.

The anal opening is situated at a varying distance behind the genital area, and the chitinous ring surrounding it may be fused with the genital plates.

The characters just given define the general appearance of any mite belonging to this genus. The sexes are easily separated by the presence of the characteristic leg segments of the male, and by the character of the genital area.

In the separation of species the characters which seem to be of most value are as follows: The length, thickness, form, and proportions of the palpi, together with the characters of the papillae and spur on the fourth segment; the lengths of the legs, relative

and absolute; the form of the segments, and whether or not the end of any of them shows a flattened expansion of the anterior surface extending beyond the base of the next segment; the character of the segments peculiar to the male; and the number and distribution of swimming-hairs. The form and details in structure of the genital area are also highly important, and the position of the anal opening is of value. Size of body and other measurements compared with body proportions are of uncertain value, since when the eggs become developed the females are swollen to a great degree, and not only is the form of the body modified but the relative proportions of other parts to the dimensions of the body are altered and the distance between the epimera increased, while their relative size is lessened.

In the beginning of this investigation the author undertook, from the comparison of a large number of specimens of *C. Reighardi*, to determine the limit of specific variation, and found specific characters to be remarkably constant, a fact which has been confirmed again and again in the comparison of individuals belonging to the other species studied.

The genus is generally distributed over the world, a large number of species being known from various parts of Europe, several from eastern Africa and Madagascar, two from Ceylon, a few from Central America and Mexico, and two from Canada.

There have been hitherto noted as occurring in North America the following species:

Curvipes numulus (Stoll) (87: 47, pl. XI, fig. 2).

Curvipes guatemalensis (Stoll) (87: 11, pl. X, fig. 2, pl. XI, fig. 1).

Curvipes alzatei (Dugès) (84: 345, pl. VIII, figs. 10-19).

Curvipes fuscatus (Hermann) (04: 58, pl. VI, fig. 9).

The two former were described by Stoll from Central America and the second later recorded by Koenike (95*b*: 209) from Canada. *C. alzatei* was described from Mexico, while the last species in the list is a well-known European form which has been noted by Koenike (*l. c.*) as occurring in Canada. *C. numulus* is quite different from any species described in this paper, having only one papilla on the fourth palpal segment and only two claws on the tip of the last segment of the palpus. The acetabula are imbedded free in the body wall in the case of the female, the male being unknown. Of *C. alzatei* the female and early stages were described; it is related,

according to Piersig (1901: 265), to *P. conglobatus* (Koch), the female of which also has the acetabula set free in the body wall and the fourth palpal segment of which is short and with prominent papillae, thus differing from *C. coronis*, described on a subsequent page of this paper. *C. guatemalensis* is closely related to *C. rotundus* (Kramer), but the palpus is thicker, the two papillae on the fourth segment are one behind the other, the distal segment has only two claws at the tip, the legs are shorter, and the hairs on the genital plates less numerous. *C. fuscatus* is in many ways similar to *C. constrictus*, also a species described in the following pages, but the genital area of the male of that species does not agree with that figured and described for *C. fuscatus* by Piersig (97 and 1901), according to whom the seminal pouch is broader than long and roughly triangular instead of elliptical. The female of *C. fuscatus* also has the plate bearing the acetabula lunate in form, while in *C. constrictus* it is solid, which serves to ally the latter with quite different species.

The collection upon which the present paper is based has been gathered at different times during several years past and represents not only the collections of the writer but contributions from others to whom he is greatly indebted. The following localities are represented:

MASSACHUSETTS.—Cranberry Lake, Woods Hole, August, 1900.

MICHIGAN.—Lake St. Clair, summer of 1893; pools near Ann Arbor, spring of 1894; Round, Pine, and other small lakes near Charlevoix, summer of 1894; Intermediate Lake, Ellsworth, August, 1894; High Island Harbor, northern Lake Michigan, August, 1894; Reed's, Lamberton, and other small lakes near Grand Rapids, summers of 1895, 1896, 1897, 1898, and 1899; Grand River, near Grand Rapids, summers of 1895 and 1898; Kawkawlin River and Saginaw Bay, August, 1895 (by J. B. Shearer); Les Chenaux Islands, northern Lake Huron, August, 1895 (by J. B. Shearer).

WISCONSIN.—Lake Winnebago, Oshkosh, August, 1897.

ILLINOIS.—Several localities near Havana (by the Biological Station, Illinois State Laboratory of Natural History).

NEBRASKA.—Circle Lake, Decatur, June, 1899 (by Chas. For-dyce); pool in Monroe Canyon, Sioux county, May, 1899; South Bend, September, 1897 (by H. B. Ward).

COLORADO.—Pond near Wray, November, 1901.

MISSOURI.—Ponds near Columbia, August, 1901.

LOUISIANA.—Pond in Audubon Park, New Orleans, fall of 1901 (by E. Foster) ; near Slidell, fall of 1901 (by E. Foster).

To those whose names appear in the foregoing list as having assisted in the collecting of material the author is deeply grateful.

The specimens have been preserved for the most part in one of the solutions recommended by Koenike, which leave the specimens in condition most suitable for dissection and the study of skeletal structures ; although precaution has been taken at the same time to preserve a greater or less number in picro-sulphuric, corrosive sublimate, alcohol, or formol mixtures in order that the natural size and form might be preserved. In the preparation of slides the author has subjected them to treatment with potassic hydrate, removing the most of the contents from the body and separating and dissecting out the mouth parts, mounting all in balsam. In the case of single specimens of the species the legs and palpus have been removed from one side and mounted in balsam, care being taken that no pressure should be put upon the body in such a way as to alter its form or proportions, and leaving the appendages of the other side in the natural position.

Through the courtesy of Dr. F. Koenike, of Bremen, Germany, the author has had specimens of the following European and other forms for comparison : *C. conglobatus* (Koch), *C. uncatus* Koenike, *C. nodatus* (Müller), *C. guatemalensis* (Stoll), *C. rotundus* (Kramer), *C. variabilis* (Koch), *C. fuscatus* (Hermann), and *C. longipalpis* (Krendowsky).

The study of the material thus secured has resulted in the detection of fifteen species, of which thirteen are new. If we add to these the species heretofore recorded we get a total of nineteen for North America, as follows :

- | | |
|---|--|
| 1. <i>Curvipes coronis</i> n. sp. | 11. <i>Curvipes medius</i> n. sp. |
| 2. <i>Curvipes numulus</i> (Stoll). | 12. <i>Curvipes rotundus</i> (Kramer). |
| 3. <i>Curvipes alzatei</i> Dugès. | 13. <i>Curvipes debilis</i> n. sp. |
| 4. <i>Curvipes exilis</i> n. sp. | 14. <i>Curvipes guatemalensis</i> (Stoll). |
| 5. <i>Curvipes pugilis</i> n. sp. | 15. <i>Curvipes Reighardi</i> n. sp. |
| 6. <i>Curvipes turgidus</i> n. sp. | 16. <i>Curvipes obturbans</i> Piersig. |
| 7. <i>Curvipes triangularis</i> n. sp. | 17. <i>Curvipes inconstans</i> n. sp. |
| 8. <i>Curvipes constrictus</i> n. sp. | 18. <i>Curvipes setiger</i> n. sp. |
| 9. <i>Curvipes spinulosus</i> n. sp. | 19. <i>Curvipes crassus</i> n. sp. |
| 10. <i>Curvipes fuscatus</i> (Hermann). | |

Unfortunately the collections have none of them been made

throughout the year in any one locality, and it has been difficult in some cases to recognize the males and females of the same species, coming in certain instances from widely different localities. But every precaution has been taken to avoid the possibility of associating together two sexes not belonging to one and the same species, and it is believed by the author that the characters which have caused the specimens to be associated as they are sufficient to reduce to a minimum the possibility of any confusion from the above conditions. In almost every species resemblances in form of palpus, the character of the papillae, the number and distribution of swimming-hairs, or form of the segments of the legs, and the characters of the genital area are sufficient to show the relationship between the sexes.

In the descriptions of the species that follow repetition of the common characters is, so far as possible, avoided, and for brevity the following abbreviations are adopted: *ep.* for epimeron; *seg.* for segment; while the successive segments of the palpi from the base out are numbered from 1 to 5, the successive epimera, beginning with the anterior, I to IV, the successive legs by corresponding numbers, and the segments of the legs by the numbers 1 to 6, beginning with the one nearest the base. In all cases the length of a segment is the length of a straight line joining the middle points of two lines connecting the extremities of the extensor and flexor margins. In the measurement of the palpi the length includes the claws at the tip, but in the case of the legs the length of the distal segment is exclusive of the claws or of the spine on the flexor side at the tip.

Although in the collections numerous immature individuals are present, in this paper all reference to preparatory stages is avoided.

II. DESCRIPTIONS OF SPECIES

I. *Curripes coronis* n. sp.

A species, of which the female is characterized by the possession of numerous acetabula imbedded free in the wall of the body, these forming a group approximately circular in outline, around the outer margin of which the acetabula form a distinct ring.

The single female specimen of this species, collected in Saginaw Bay, Mich., is 1.254 mm. long and 1.079 mm. wide. It is broadly ovate with the anterior margin slightly produced in front of each eye

and excavated between them, and the surface shows the usual fine striation. The eyes are 0.349 mm. apart, while the short, straight antenniform bristles are separated by a distance of 0.317 mm.

The palpus (pl. I, fig. 2) is 0.821 mm. long, and of this the different segments make up the following percentages: 8, 27, 10, 37, 18. Seg. 1 is one-half as broad again as long; seg. 2 somewhat less broad than long; seg. 3 much broader than long; seg. 4 rather slender, tapering, and slightly dilated in the middle; while seg. 5 tapers decidedly from the base to the tip. On the flexor side of the fourth segment are two papillae, one of which is very long, the other half its length, set obliquely and bearing short hairs. The same segment has a short curved claw at the tip of the flexor margin. The tip of seg. 5 bears three moderately short curved claws. The spines on the palpus are more numerous than in any other species examined. Seg. 1 has the usual small spine at the tip of the extensor margin; but on seg. 2 there are, instead of the usual three on the inner surface, three in a row near the extensor margin, one a little out of line near the distal end, and one at the tip of the extensor margin, while on the outer surface, instead of two, there are two close together near the extensor margin, one near the middle of this surface, and two at the distal end, side by side. Seg. 3 has the usual number, while seg. 4 has numerous short hairs borne on small papillae.

The epimera (pl. XXIX, fig. 1) are widely separated across the median line, II and III being nearer together but still with a considerable interval between.

The legs are proportionately long, the first exceeding the body length by nearly one-fourth. The individual segments are, in order of length, 5, 4, 6, 3, 2, 1, except that in the first leg 6 is longer than 4, while in the last leg 4 is longer than either 5 or 6. No particularly noteworthy details of structure are present.

Segs. 4 and 5 of leg I possess two and five long hairs respectively, and the corresponding segments on leg II bear six and eight hairs, while on leg III are eight and eleven long hairs, and on leg IV seven and twelve swimming-hairs on the same two segments.

The genital area (pl. XXIX, fig. 1) is bounded in front by a long, transversely placed chitinous plate similar to that in *C. turgidus*. The median area is broadly elliptical in form and the acetabula are distributed over two lateral areas nearly circular in outline, their

posterior margin extending behind the posterior margin of the median area by a considerable distance and leaving between the two a considerable space. Within these lateral areas are 23 and 28 acetabula respectively, imbedded in the wall of the body. They are, for the larger part, arranged in a row about the outer margin, while a few are scattered over the center of the area.

Measurements of the single female specimen give the following figures:

Body	1.254 mm.
Leg I.....	1.541 mm.
Leg II.....	1.766 mm.
Leg III.....	1.805 mm.
Leg IV.....	1.997 mm.
Palpus.....	0.821 mm.

Type retained in the author's collection.

The single female from which this species is described was collected in Saginaw Bay, Lake Michigan, August, 1895, by J. B. Shearer, of Bay City, Mich., and was apparently of a red color when living.

The name is bestowed in allusion to the curved row of acetabula about the group of such structures, which are imbedded free in the body wall. From all the described species of which the latter statement is true, the present specimen seems to be quite different.

2. *Curvipes exilis* n. sp.

A species characterized especially by the excessive length of the palpi, which are also very slender proportionally, and the fourth segment of which is remarkably contracted at the base. It is of medium size, the body elliptical in form, five-sixths as wide as long and approximately the same in height, the highest point being in front of the middle of the body. Measurements of several specimens from Lake St. Clair preserved in picro-sulphuric and corrosive sublimate solutions give a maximum length for the male of 0.968 mm., a minimum of 0.825 mm., and an average of 0.87 mm., while the single female measured possessed a length of 0.92 mm.

The body is marked by proportionately coarse, irregular lines on its surface. The eyes are situated a little back from the margin, the distance between them being equal to somewhat less than one-third the length of the body. They are black in color.

The maxillary shield is broadest anteriorly, with rather straight sides which converge posteriorly, and a rounded posterior margin, while the ancoral process is rather short and broad.

The mandibles, which are almost miniatures of those of the next species, are long with uneven outline, the dorsal margin convex distally and concave proximally, forming together with the posterior margin a relatively short and blunt process; claw long, slender, rather straight, more sharply curved at the tip, where it is finely serrate, and much exceeding the dorsal margin. The serrations are directly backward and limited to the terminal portion of the claw. The length is 0.312 mm. in the case of a specimen about 0.825 mm. in length.

The palpus (pl. XXIX, fig. 4), which is alike in both sexes, is very long, nearly equaling the length of the body, and relatively slender, though thicker than the first pair of legs. The measurements of the successive segments give the following percentages of total length: 7, 28, 13, 34, and 18. Seg. 2 has a straight flexor margin and an extensor very slightly convex, its greatest thickness being only equal to about four-sevenths of its length; seg. 3 is barely longer than thick; while seg. 4 is nearly five times as long as thick at the base. The latter segment is much contracted close to the base, where it is the narrowest, while it is widest about the middle. Seg. 5 tapers very rapidly from the base to a distance equal to about one-fourth of the total length, after which the diameter diminishes very gradually to a tip which is rather squarish and bears in addition to three small claws at the end one small one just behind them on the extensor margin. The papillae on seg. 4 are oblique to one another, the distance between their bases measured along the margin of the palpus being somewhat less than one-third the distance from the base to the first and a little over two-thirds the distance from the more distal of the two to the base of the spur at the tip of the segment. The outer of these two papillae is the longer and is equal to one-third the width of the segment at that point. The spur at the tip of this segment is prominent and shelf-like, containing a short, straight claw.

The epimera cover a large part of the ventral surface and are separated from one another by a considerable interval in the case of the female, but are approximate in the case of the male. The posterior process on ep. 4 is short and blunt.

The legs are long, even the first exceeding by about one-third the length of the body; II and III are approximately equal and considerably longer than I; while IV is again much longer than either of the two preceding. They are abundantly supplied with spines, and seg. 5, which is first dilated and then contracted at the outer end, is furnished with a conspicuous double row of stout spines on the flexor surface. The distal end of this segment exhibits a curious modification, the anterior side being produced and forming several teeth. There are in the case of the male long, slender hairs on segs. 4 and 5 of leg II, seven on the former and five on the latter segment; leg III also possesses, on each of segs. 4 and 5, about five or six swimming-hairs; while on seg. IV 4 are three and on seg. IV 5 six. In the female, leg I possesses six long hairs on the posterior side of seg. 5; leg II, six and eight on segs. 4 and 5 respectively; leg III, seven or eight and nine on the same segments; and leg IV, two on seg. 3, five swimming-hairs on seg. 4, and seven on seg. 5. The distal segment of leg III in the male (pl. XXIX, fig. 7) is long, moderately slender, slightly curved, and longer along the flexor than along the extensor margin; its claw is short and weakly curved. On seg. IV 4 (pl. XXIX, fig. 3) there are, proximad of the excavation, two rows of three stout spines each and two spines between these rows; distad of this excavation are four in an oblique line leading to the swimming-hairs.

The genital area in the male (pl. XXIX, fig. 8) shows a fusion of the chitinous plates with the fourth epimeron. The genital cleft is short and surrounded by a seminal receptacle in the form of a depression which is elliptical in form and with an even rim. In the median line directly behind this opening there are no acetabula, but, beginning with a row of the acetabula at either side at this point, there may be counted a total of 45 to 50 on each side. The chitinous plates on which these rest are long, tongue-like, and, owing to the form of the posterior margin of the fourth epimeron, show an excavation of the anterior margin, while the outer and posterior margins are evenly rounded.

In the case of the female (pl. XXIX, fig. 5) the much longer genital cleft is surrounded by an elongated, elliptical area flanked on either side by chitinous plates which are in contact with it along the posterior half of either lateral margin, but which do not meet caudad of it. The tongue-like chitinous lateral plate extends to a point

even with the posterior spine on the fourth epimeron. In the male the chitinous ring surrounding the opening is connected with the genital area; while in the female it lies some distance behind this and free in the wall of the body.

Measurements of two specimens give the following figures:

	MALE	FEMALE
Body.....	0.825 mm.	0.920 mm.
Leg I.....	1.056 mm.	1.205 mm.
Leg II.....	1.104 mm.	1.310 mm.
Leg III.....	1.066 mm.	1.339 mm.
Leg IV.....	1.248 mm.	1.546 mm.
Mandible.....	0.312 mm.	.....
Palpus.....	0.696 mm.	0.854 mm.

The color of this species, as briefly noted in field notes taken at Lake St. Clair in the summer of 1893, was "transparent with a brownish tinge; with brownish yellow patches and Y-shaped mark of white dotted with carmine; brownish red eyes; and legs that were blue with the terminal joints brownish yellow."

The types are retained in the collection of the author; co-types have been deposited in the collection of the Zoological Laboratory, the University of Nebraska, and in the United States National Museum.

Specimens of this species were taken at Lake St. Clair in the summer of 1893, sixteen males and four females altogether. One male taken at Wray, Col., November 16, 1901, is also put here, being apparently identical.

The specific name is bestowed in allusion to the slenderness of the palpi, which are also longer than in any described form, and which serve to distinguish this species from all others hitherto known. The form is in length of palpi and in other details similar to the next species but is readily distinguishable.

3. *Curvipes pugilis* n. sp.

A large species similar to *C. exilis* in palpal characters, but characterized by the curvature of the distal segments of the legs. It has an elliptical body, uniformly arched, highest a little behind the middle with a prominence in front of each eye and a slight excavation between them. The breadth is about equal to four-fifths the length and the height equal to nearly nine-tenths of the same. Measurement of several males and females from Lake St. Clair, preserved

in corrosive sublimate and picro-sulphuric, give a length, for the males, varying from 1.25 mm. to 1.5 mm., the average being 1.42 mm.; for the females varying from 1.5 to 1.7 mm., the average being about 1.58 mm. The body is marked by very fine wavy lines over the surface. The eyes are relatively small and moderately distant from the anterior margin, while the distance between them is proportionately rather great. The antenniform bristles are extremely small and inconspicuous.

The maxillary shield and the ancoral process, owing to the straightness of the sides of the former and the breadth of the latter at the base, form together a roughly triangular mass, truncate at the tip.

The examination of the mandibles of several males shows them to be similar to that of the preceding species, though the claw is longer, larger, and more strongly hooked. The serrations on the claw are small, gradually disappearing toward the base. In a specimen the length of which was about 1.3 mm. the mandible was found to be 0.405 mm. long.

The palpi (pl. XXIX, fig. 9) are long, being, in a male, six-sevenths the body length. The general form is slender, though they are thicker than leg I. Seg. 1 is proportionately short; seg. 2 rather long and with a maximum thickness equal to about six-tenths the length; seg. 3 thicker than long; while seg. 4 exhibits a maximum thickness of only one-quarter its length. Seg. 5 is long proportionately and tapers gradually from the base to the tip, where it is somewhat less than half the thickness of the base. The papillae and spine on seg. 4 are similar in position and form to those of *C. exilis*, but are all noticeably smaller; while there are also several small hairs in addition on the outer surface; seg. 5 has three small, curved claws at the tip, and an additional rudimentary one on the flexor margin behind the tip.

The epimera cover a considerable portion of the ventral surface, are in the female separated by a moderate interval, and in the male are close together, I and II crowding the maxillary shield. The posterior projection of ep. IV is rather long but bluntly rounded.

The legs are long, even the first being considerably longer than the body, while the fourth is more than half as long again. The length of the individual segments is, in each leg, in order, beginning with the longest, 5, 4, 6, 3, 2, 1. Seg. IV 6 is, however, proportionately lengthened in the female; III 6 is shortened in the male; and

IV 4 also shortened in the latter sex, being shorter than IV 6. In thickness the segments gradually decrease from the base out, except that in the first three pairs of legs seg. 5 is much thickened, exceeding in thickness in I and II all segments but the basal, and is closely beset with coarse spines on the outer half of the flexor margin. The distal segment of the first three legs is peculiar in being strongly curved (pl. XXIX, fig. 11), this curvature being greatest in the case of the first pair of legs. The distal end of seg. 5 is also peculiar in the possession of a terminal expansion on the anterior side similar to that seen in *C. exilis*, extending, in the case of legs I and II, considerably beyond the base of seg. 6; this is less prominent on leg III and not developed on leg IV. The claws are small and possess two sharp, curved points and a narrow basal expansion. In the case of the male, seg. III 6 (pl. XXIX, fig. 10) is somewhat curved, slightly thickened at the outer end, and with a very weak claw with strongly curved tips. Seg. IV 4 shows, on the anterior side, a row of seven spines along the flexor margin and about five, small but of varying length, along the extensor margin; while on the posterior surface there are, proximad of the excavation, about twelve or thirteen spines increasing in size distally; in the excavation, three short, blunt, slightly curved spines toward the extensor margin and one large one on the flexor margin; and distad of it three stout spines in a row, and in line with these, at the tip, seven swimming-hairs. Aside from these the number of hairs is as follows: On II 4 and II 5, six and eight respectively; on III 3, two at the tip; on III 4, nine; on III 5, ten; and on IV 5, ten swimming-hairs. In the female there are seven long slender hairs on the posterior side of I 4, seven on I 5, seven on II 4, ten on II 5, two on III 3 at the tip, ten on III 4, twelve on III 5, two on IV 3, and ten each on IV 4 and IV 5, those on IV being swimming-hairs.

The genital area of this species exhibits a length from the extreme anterior end to a line tangent to the posterior margin of the lateral chitinous plates of one-half that of the extreme breadth. The genital cleft is short, and the two lateral chitinous plates are separated by a considerable interval behind it in the case of the female, while in the case of the male (pl. XXIX, fig. 12) the two plates approach each other closer and the chitinous anal ring is fused with them. Each lateral plate is tongue-like with the anterior margin excavated, and the outer and posterior more or less

evenly rounded. Each possesses from 60 to 70 acetabula, of which two are noticeably larger than the rest and are situated in the middle of the plate. In the male the plates are fused with the inner end of the last epimera.

MEASUREMENTS

	MALE	FEMALE
Body	1.270 mm.	1.555 mm.
Leg I.....	1.656 mm.	1.776 mm.
Leg II.....	1.781 mm.	1.896 mm.
Leg III.....	1.723 mm.	1.982 mm.
Leg IV.....	1.934 mm.	2.198 mm.
Palpus	1.066 mm.	1.094 mm.
Mandible.....	0.381 mm.	.....
Extreme breadth of genital area.....	0.714 mm.	.....

The color of this species can not be stated with certainty from the preserved specimens. The legs, however, possess a very dark bluish tinge with the exception of the distal segments which are brownish.

The types are in the collection of the author; co-types have been deposited in the collection of the Zoological Laboratory, the University of Nebraska, and in the United States National Museum.

Altogether thirteen males and nine females were taken at Lake St. Clair, Mich., during the summer of 1893; four males and three females were collected by Mr. J. B. Shearer at Les Chenaux Island, northern Lake Huron, in August, 1895; while one male and one female were collected in Twin Lakes near Charlevoix, Mich., August 6 and 13, 1894, making a total of thirty-one specimens.

The name is bestowed in allusion to the form of the distal segments of the legs, which are in all the preserved specimens flexed in such a manner as to suggest a resemblance to the position of the arms of a boxer.

This species closely resembles, in the form of the palpus, the mandible, and the genital area, the preceding species, but differs in details and especially in the form of seg. 6 of the legs.

4. *Curvipes turgidus* n. sp.

A species characterized by its size, the characters of the palpi, the length of the legs, and the appearance of the genital area.

The female of this, one of the largest species yet met with, judging by the measurement of about a dozen specimens, averages 2.3 mm. in length and 1.78 mm. in width, with a variation in length be-

tween 2.55 mm. and 2.01 mm. Two males which seemed to have preserved nearest the natural size and form measure 1.34 mm. and 1.40 mm. respectively. The body is broad and high, being highest at a point three-fourths of the way back from the anterior margin, while there is a slight constriction behind the eyes. From the dorsal aspect the body is oval, narrowed anteriorly, and emarginate between the eyes, which are of moderate size and about one-third the width of the body apart. The surface is finely striate. The two antenniform bristles are somewhat closer together than the eyes, and each is awl-shaped, short, straight, and slender.

The maxillary shield is rather broad and the ancoral process on it long and presenting a shallow concavity at the side and a deep notch at the tip. The ventro-posterior angle of the mandible is short and blunt and the dorsal and ventral margins are nearly parallel. The claw is stout and slightly curved and the serrations are few and confined to the tip.

The palpus (pl. XXX, fig. 22) is relatively long and slender. The percentage lengths of the segments in order from the base out are: 9, 26, 12, 36, 17. Seg. 1 is only about one-third broader than long; seg. 2 only three-fifths as thick as long, with a straight flexor and a slightly convex extensor margin; seg. 3 possesses a uniform diameter slightly less than the length; seg. 4 is dilated in the middle, where the diameter is equal to about three-sevenths of the total length, and the thickness is slightly less at the tip than at the base; while seg. 5 is somewhat less in diameter at the base than half its total length and tapers uniformly to the tip, where it is half as thick at the base, is curved ventrad, and bears three short, curved claws. On the flexor margin of seg. 4 are two long papillae set obliquely, conical in form, and bearing short hairs, the inner one of which is somewhat less than half the distance from the base to the tip of the segment, while the outer, the longer, is at a distance of about five-eighths from the base. There are also two small papillae mid-way between these and the distal end, like them placed obliquely, with the longer on the outer side, and the shelf-like claw at the end. The papillae on the palpus of the female are all proportionately shorter than those of the male.

The epimera of the female are of moderate size and a rather narrow interval separates II from III, while III and IV of either side are separated by a distance equal to somewhat less than one-

third the length of their inner margin. Those of the male are in close apposition. The posterior process on ep. IV is rather long and the margin of epimeron within it is nearly straight.

The legs are long and rather heavy, the first pair of the female being somewhat less than the length of the body, the other three slightly exceeding it, while all those of the male exceed the body length by considerable. There is very little difference in length between the first and last legs of the female. In the male the third pair of legs is the shortest, and the last is exceeded by the second pair. The individual segments of the female are of nearly uniform thickness from base to tip, the distal segment being only slightly dilated at the outer end, and the usual order of segments in regard to length is 5, 4, 6, 3, 2, 1. In leg III seg. 4 is shorter than the corresponding segment of leg II, while seg. 5 is practically equal to the corresponding segment of leg II. In leg IV segs. 4 and 5 are shorter than the corresponding segments of leg III, and seg. 6 is shorter even than the corresponding segment of leg I. In the male the sixth segment is longer than the fourth except in leg III. In leg III of this sex segs. 1 to 4 are short and 5 is long, while in the last pair of legs 3 is very short, being exceeded both by 2 and 1, and 4, 5, and 6 are also relatively short. Leg I of both sexes has eight or nine slender hairs on the posterior side of seg. 5 and two near the outer end of seg. 4; leg II has a row of about ten on seg. 4 and from twelve to fifteen on seg. 5, in a row from near the base of the segment out. Leg III has, in the female, a row of fifteen on seg. 4 and nineteen on seg. 5, the male having the same number of very small hairs on seg. 4, while those on seg. 5 are lacking. Leg IV of the female has about ten swimming-hairs in a close row at the end of seg. 4 and from twelve to fifteen swimming-hairs at the end of seg. 5, the male having seven and from fifteen to seventeen on the same segments respectively. In the male seg. III 6 (pl. XXX, fig. 19) has a straight extensor margin and a curved flexor, the tip being broadly expanded. Seg. IV 4 of this sex (pl. XXX, fig. 23) is very broad with a deep excavation on the posterior side, on which side the tip is strongly produced; there are about eighteen spines proximad of the excavation and about twelve distad of it, together with from six to eight swimming-hairs. The distal end of the fifth segments in all the legs of the female, and in the first two of the male, is expanded on the anterior side.

The median area of the genital field in the female (pl. XXX, fig. 20) is limited anteriorly by a very long, transversely placed chitinous plate between the inner ends of the last pair of epimera. The length of the genital cleft is equal to slightly less than half the breadth of the whole field, which in turn is slightly more than one-fourth the breadth of the body. The two flaps which close the cleft are rather broad and are bounded from the middle of the lateral margin clear around to the median line by solid tongue-shaped chitinous plates which bear each from forty to fifty acetabula, two of which are slightly larger than the rest. The narrow portion of each plate, which extends inward behind the genital flaps to meet its fellow of the opposite side, possesses no acetabula, but bears, where it leaves the main body of the plate, a row of three or four short hairs. In the male (pl. XXX, fig. 21) there is a capacious seminal pouch which is broadly open anteriorly. On either side of the median line behind the opening of this is an approximately circular genital plate bearing somewhat over fifty acetabula, the posterior margin of this plate being evenly rounded, the anterior slightly excavated, while the two are separated by a moderate interval.

The anal opening is situated at some distance behind the genital area and is imbedded free in the wall of the body.

Measurements give the following results:

	MALE	FEMALE
Length of body.....	.....	.....
Leg I	1.661 mm.	2.218 mm.
Leg II.....	1.862 mm.	2.331 mm.
Leg III	1.483 mm.	2.346 mm.
Leg IV.....	1.733 mm.	2.467 mm.
Palpus	0.893 mm.	1.099 mm.
Inner margin of ep. III and IV.....	.....	0.413 mm.
Distance between ep. III and IV.....	.....	0.127 mm.
Length of genital cleft.....	.....	0.333 mm.
Extreme breadth of genital cleft.....	.....	0.651 mm.

The types are retained by the author; co-types have been deposited in the collection of the Zoological Laboratory, the University of Nebraska, and in the United States National Museum.

Of this species there were collected in High Island Harbor, northern Lake Michigan, August 18, 1894, nine males and two females, the color of which can not be given. In the summer of 1895 the species was present in large numbers in a small bog-lake or pond near Grand Rapids, Mich., only about 100 yards in diam-

eter. Females alone, of large size, being distended to the utmost by eggs, were secured, twenty-one specimens being now at hand for examination. All of these were of a brilliant scarlet-red color with darker patches and black eyes. One female specimen was also received from Mr. J. B. Shearer, of Bay City, Mich., collected in Saginaw Bay, August, 1895, and five males and one female were secured in Lake Winnebago, Oshkosh, Wis., August, 1897.

The species bears a resemblance to *C. longipalpis* Krend, and *C. nodatus* (Müll.), two widely diffused European species, but is clearly distinct, being told from *C. nodatus* at first glance by the much larger number of acetabula, and differing from *C. longipalpis* in the possession of four papillae on segment 4 of the palpus, in the details of structure of the genital area, and in other structural features. From *C. fallax* Thon the species differs in the form and proportions of the genital area, the measurement of legs and palpi, and especially in the character of leg III of the males.

The name is in allusion to the large size, especially of the females.

5. *Curvipes triangularis* n. sp.

A species resembling closely *C. nodatus* (Müll.) and *C. turgidus*, but differing from either and characterized by the form and structure of the palpi and genital area. The three specimens taken possess an unusually delicate chitinous covering.

The body of these specimens is, in general, elliptical in form, but this general form is modified by a different degree in each one of the three. One shows a distinct depression between the eyes and also a posterior emargination on either side. The others show a less distinct posterior emargination, and one is anteriorly even convex. The body is rather low and flattened when viewed from the side and exhibits also a slight indentation behind the eyes. The longest of the three is 1.27 mm., the shortest 0.92 mm. The width of the first is 1.02 mm. and its height 0.89 mm., while the second is 0.71 mm. in width. The surface is everywhere finely striate.

The eyes are situated near the anterior margin and are a trifle more than one-third as far apart as the body is wide. They are large and brownish in color. The antenniform bristles are short and flattened.

The maxillary shield is rather broad and short and the same is

true of the ancoral process. The mandible in the case of the specimen 0.92 mm. long, from which a slide preparation was made, is 0.346 mm. in length. Its ventral margin is long, its dorsal short and forming a very obtuse angle with the posterior margin, while the ventro-posterior angle is long and moderately pointed. The claws are very long, strongly curved at the base, then straight and hooked at the tip, towards which is the usual fine serration.

The palpi (pl. XXXI, fig. 32) are long and slender and the different segments make up the following percentages of the total length: 9, 25, 12, 34, 20. The inner margin of seg. 2 is straight; that of seg. 3, concave; seg. 4 is dilated and possesses on its flexor surface two long papillae placed obliquely to one another, of which the inner is about at the middle of the segment, the outer midway between that and the distal end. The spur at the tip of this segment is shelf-like. Seg. 5 is much elongated, decreases uniformly in thickness, and exhibits a curvature ventrad, being terminated by three small claws.

The epimera are separated by a considerable interval and the inner margin of III and IV is short with the angle at either end rounded, the length of the two together in the mounted specimen being 0.216 mm. The angle on the posterior margin of IV is of moderate length.

The legs are long, all exceeding the body length, the fourth by about one-half. The individual segments are, in the order of length, 5, 4, 6, 3, 2, 1; they present no noteworthy details of form. There are the following hairs to be noticed: On seg. I 4, one at the tip, and on I 5, two; on II 4, six, the first at one-third the distance out from the base; on seg. II 5, eight; on III 4 and 5, seven and nine respectively; while on seg. IV 4 and IV 5 are five and seven swimming-hairs.

The genital area (pl. XXXI, fig. 33) exhibits a median, elliptical, much elongated area flanked on either side by two plates tongue-like in form, concave along the front margin, strongly convex along the posterior and rounded at the outer end. These plates meet the median area in such a way as to leave free the anterior half of the lateral border and a distance at the posterior end between them nearly as great as the breadth of the plates themselves. Each bears from twenty-five to thirty acetabula, of which two are larger than the rest.

Measurement of the mounted specimen gives the following figures:

Body	0.920 mm.
Leg I.....	1.152 mm.
Leg II.....	1.262 mm.
Leg III.....	1.282 mm.
Leg IV.....	1.382 mm.
Palpus.....	0.744 mm.
Total length of mandible.....	0.346 mm.
Length of genital area along median line.....	0.216 mm.
Total breadth of genital area.....	0.376 mm.

The type of this species is retained in the collection of the author.

Of this form only three females were collected in a pond near Columbia, Mo., during the latter part of August, 1901. It differs from *C. nodatus* (Müll.), to which it bears a very close resemblance, in the lack of the third papilla on seg. 4 of the palpus and of numerous hairs belonging to the same segment, in the lack of hairs on ep. IV, and in numerous other details of structure where the difference is one of degree rather than kind. From *C. turgidus* it is easily distinguished by the palpal characters, form of epimera and space between them, form of genital area, number of acetabula, etc.

The name is suggested by the form of the genital area, which is approximately triangular.

6. *Curvipes constrictus* n. sp.

A well-marked species, most closely resembling *C. carneus* (Koch) but clearly distinct, and characterized by the form of the palpi, of the genital area, and of the characteristic leg segments of the male.

The body of the single male under observation is relatively long, smoothly rounded posteriorly, but deeply emarginate between the eyes and also much constricted behind them, which constriction is apparent both from the dorsal and lateral view. The width is a little less than three-fourths the length and the height somewhat less than the width. The female which is placed with this male is much larger and of similar proportions, but neither so deeply emarginate between the eyes nor so much constricted behind them. The surface of the body in both is marked by fine lines.

The eyes of the male are separated by an interval equal to some-

what over two-fifths the width of the body, those of the female somewhat less than the two-fifths, the exact measurements being 0.287 mm. and 0.46 mm. respectively. The antenniform bristles rise from evident papillae, are long, curved upward, and separated from one another by a distance somewhat less than three-fourths that between the eyes. In the male they are $19\ \mu$ in length.

The maxillary shield is evenly rounded posteriorly with a very short ancoral process, which is only slightly excavated at the sides and not broadly dilated at the tip.

The palpi of the male (pl. XXX, fig. 17) are proportionately rather short, being about two-fifths the body length; while in the female, owing to the larger size of the body, they are proportionately even smaller, and measurement shows them to be actually somewhat shorter than those of the male. They are hardly wider than the first pair of legs in the case of the male and narrower in that of the female. Of the separate segments the relative lengths are represented by the percentages: 9, 32, 12, 28, 19. The first is nearly twice as broad as long and is strongly angulated on the flexor side; the second is only five-sixths as thick as long and has a relatively short flexor margin; seg. 3 is half as thick again as long; seg. 4 is moderately slender and slightly dilated at the middle, where it is about as thick as at the base; while seg. 5 is usually slender, being about half as broad at the tip as at the base and unusually pointed. The usual spines are present but somewhat longer than the average. The two papillae on the flexor side of seg. 4 in the male are oblique to one another, the inner being the more distal, are equal in size, and are conical, with small hairs at the tip. The spur at the tip of the flexor margin of this segment is represented by a very stout flat spine. The claws at the tip of the last segment are long and much crowded, owing to the narrowness of the tip, and the middle one lies on the outer side of the other two; while on the flexor side, behind the claws, is a slender curved hair. In the female the two papillae on seg. 4 seem to be nearly in line.

The epimera occupy, in the case of the male (pl. XXX, fig. 15), the anterior half of the ventral surface; in the case of the female (pl. XXX, fig. 14) less, being in this sex proportionately very small. In the male the space between the inner ends of the two anterior pairs of epimera is wide and the exposed body surface is consider-

able. Ep. II and III of each side are separated by a rather wide interval, and the anterior ends of III of the opposite sides are also separated slightly from one another, though the two last epimera are fused. Within the process on the posterior margin of IV, which is itself rather blunt, the margin of the epimeron is deeply excavated. In the female the four masses formed by the unusually small epimera are widely separated from one another.

The legs of the male are moderately long, the first exceeding the length of the body by about one-fifth, while the last is short and scarcely exceeds the first. Owing to the large size of the female the legs appear smaller than in the male, although actually somewhat longer, with the exception of leg III, which is exceeded by the corresponding leg of the male. The distal segment is rather long. In the male the length of the individual segments of legs I and II are, in order, 6, 5, 4, 3, 2, 1. In leg III of this sex both 5 and 4 exceed 6, while in leg IV, 5 and 6 are approximately equal and longer than 4. In the female the same proportion holds good for legs I and II; in leg III, 5 and 4 are nearly equal and both exceed 6, which is also true in leg IV. Leg I of the female has a long spine at the distal end of seg. 3, six long hairs on the outer third of seg. 4, and eight long hairs at the outer end of seg. 5; leg II has a similar long spine at the distal end of seg. 3, eight long hairs from the middle out in seg. 4, and eleven from the middle outward in seg. 5 (*cf.* pl. XXX, fig. 18); leg III possesses two long spines on 3 and nine and ten on 4 and 5 respectively, disposed as in leg II; while leg IV possesses also two long spines on 3 and seven and eight swimming-hairs at the tips of segs. 4 and 5. The male shows similar long spines at the tip of seg. 3 on legs I, II, and III, five and seven long hairs at the tip of 4 and 5 respectively in leg I, seven and nine on the corresponding segments of leg II (pl. XXX, fig. 18), and five and seven on the same segments of leg III, six on the latter leg being very fine. Seg. III 6 (pl. XXIX, fig. 13) is of the form of a cornucopia, the outer end of which opens toward the flexor side, and bears a small, short, strongly curved claw. Segs. 1 to 4 on leg IV (pl. XXX, fig. 16) are very broad and 5 and 6 slender, contrasting strongly with the other four; seg. 4 is especially broad and the excavation correspondingly deep. There are, proximad of this excavation, about seventeen spines, irregularly distributed, all very stout and curved, those nearest the proximal

end short but becoming longer and saber-shaped as one passes outward; on the flexor side are two long, stout, sharp spines, while toward the extensor side is one, in the excavation; distad, there is a marked dilatation, and on the flexor face of this are situated nine stout, curved spines and beyond them, at the tip, are three slender swimming-hairs. On the extensor side of this segment are three small spines toward the base and one at the tip, together with four long ones on the flexor side near the anterior margin. Seg. 5 is evidently somewhat contracted in the middle and dilated at its distal end, where it bears fifteen swimming-hairs in a crowded row. The corresponding segment in the female is somewhat contracted in the middle and to a slight degree the same is true of the corresponding segments of the anterior legs in both sexes.

The genital area of the male (pl. XXX, fig. 15) is in contact with the posterior epimera in the median line and again at the tips of the processes on the posterior margin and is very characteristic in appearance. In the median line is a broad disk one-half broader than long, elliptical in outline, and with a conical anterior projection in the median line in front which reaches the posterior epimera and which possesses a length equal to about one-fourth the length of the rest of the area. On either side of this area are the genital plates bearing nine and ten acetabula respectively and separated by a considerable interval along the posterior margin of the elliptical area referred to. The anal opening is situated a moderate distance behind the genital area and entirely separated from it.

The genital area in the female (pl. XXX, fig. 14) is proportionately smaller than in the male and exhibits a median elliptical area four-fifths as broad as long. On either side of this are two small crescent-shaped plates closely applied to about two-thirds the lateral of this area, being separated from each other by a considerable interval posteriorly; each bears ten acetabula.

Measurement of the two specimens under observation:

	MALE	FEMALE
Body	0.920 mm.	1.730 mm.
Leg I	1.056 mm.	1.094 mm.
Leg II	1.142 mm.	1.214 mm.
Leg III	1.368 mm.	1.243 mm.
Leg IV	1.075 mm.	1.373 mm.
Extreme breadth of genital area	0.333 mm.	0.317 mm.
Length of same along median line	0.115 mm.	0.238 mm.
Palpus	0.360 mm.	0.341 mm.

The color of neither can be told from the preserved specimens. Yet there are certain indications that both were pale red or flesh-colored, with patches of light brown, and that in both the legs were strongly tinged with salmon.

The types are retained in the collection of the author.

The male of this species was taken in material collected in temporary pools formed by melting snow in the woods four miles west of Ann Arbor, Mich., in the latter part of March, 1894. The female was collected in a spring-fed pool in Monroe Canyon, Sioux county, Neb., between May 28 and 30, 1899. No other specimens have ever come under the observation of the writer, and while he has at first hesitated to assign these two to the same species, the points of agreement are so numerous and striking as to leave comparatively little doubt that they represent the two sexes of one and the same species.

C. constrictus most closely resembles *C. carneus* (Koch), a generally distributed European species, but differs in the structure of the palpi, in the relatively longer legs, in the character of seg. III 6 of the male, in there being three instead of nine swimming-hairs on seg. IV 4 of the male, in the details of structure of the genital area in both sexes, and in the number of acetabula, which is ten in each sex, instead of fifteen in the male and from eighteen to twenty-four in the female. The distal segment of the third pair of legs resembles that of *C. coccinoides* Thor, but the two are quite unlike in other respects.

The name refers to the contraction of the fifth segment of the legs.

7. *Curvipes spinulosus* n. sp.

A species characterized by its small size, the paucity of spines on the legs, and other details of structure.

The smallest of our species and one which appears to be also quite variable. The average length of a large number of specimens collected from the Twin Lakes near Charlevoix, Mich., in the summer of 1894, and preserved in corrosive sublimate, is 0.53 mm. and the average width 0.436 mm. with a height distinctly less than the width. The males and females collected were of about the same size and, judging by the examination of a number of the latter, the size is not subject to much increase during the development of the eggs, of which only a few were found in any individual.

In form the body is broadly elliptical and presents only a slight depression between the eyes. It is evenly convex dorsally with the surface and the cuticula thin. The antenniform bristles are of medium length, straight, and about the same distance apart as the eyes. The latter are very large and distant from the anterior margin. The average of several specimens gives for the distance apart 0.127 mm., and for the diameter of the eyes themselves 44 μ .

The maxillary shield is of moderate size, expanded anteriorly, and the ancoral process in the female relatively short and strongly hooked, in the male longer and lying beneath the inner ends of ep. I. The mandibles are relatively long with a stout, strongly hooked claw, the serrations on which extend half way toward the base.

The palpus in both sexes is about two-thirds as long as the body, while the percentage length of the different segments is as follows: 10, 28, 13, 31, 18. In the male (pl. XXXI, fig. 27) the first segment is about half as thick again as long; the second segment somewhat narrower than long with its flexor surface very convex; seg. 3 is thicker than long, and with the flexor surface even more concave than the extensor is convex; and seg. 4 is dilated in the middle, where its breadth is somewhat more than half the length of segment. The latter segment bears at the middle two conical papillae set at such an angle that the distal side is at right angles to the long axis of the segment; these are nearly opposite, the outer somewhat the longer, and each possesses a long hair. The spur at the tip of this segment is blunt. Seg. 5 tapers evenly from base to tip and is relatively broad and blunt and bears at the tip three claws. In the female (pl. XXXI, fig. 28) the segments taper more uniformly from base to tip, seg. 4 is not dilated, and the papillae on the flexor side of this segment are relatively very much shorter.

The epimera of the male (pl. XXXI, fig. 25) are very close together, those of the female (pl. XXXI, fig. 24) separated by only a narrow interval, in both sexes covering almost the entire ventral surface and leaving space posteriorly for only the genital area. The process on the posterior side of the fourth epimeron is rather long and sharp, and within this the outline of the margin is evenly and slightly concave.

The legs in both sexes are relatively long and heavy, the first exceeding the body by one-third. In the male the flexor side of the fifth segment in the anterior two legs is strongly convex, and the

distal segment of the same legs club shaped and relatively large. In the third leg of this sex seg. 5 is markedly elongated and possesses a low angle on the extensor margin in the middle, while seg. 6 (pl. XXXI, fig. 26) is short and stout, being nearly as thick at the base as at the tip, and in different specimens more or less curved ventrad; its claw is long, straight, very sharp, and in length nearly two-thirds the length of the segment. In this sex there are two fine hairs on seg. I 5 and two long spines on each of segs II 4, II 5, and III 4, with two swimming-hairs in addition at the tip of III 4. On seg. III 5 are no swimming-hairs but a row of four long, strong spines, which increase in length toward the tip and of which the distal surpasses by considerable the tip of seg. 6. There are three swimming-hairs at the tip of seg. IV 4 (pl. XXXI, fig. 29) and four at the tip of IV 5. In the female, leg II possesses two long spines on segs. 4 and 5; leg III, five on each of segs. 4 and 5; while leg IV possesses one long hair at the tip of seg. 3 and four swimming-hairs at the tip each of segs. 4 and 5. As a whole the legs bear relatively few spines, but these are comparatively stout.

The genital area is similar in form in the two sexes, the lateral plates, which bear in the male 25 to 30 acetabula and in the female from 20 to 25, being tongue-like in form, meeting the median portion along its entire margin, and extending laterally beyond the angle on ep. IV. Their inner ends are, in the male, fused with the inner angles of the last epimera. The median area is elliptical in form in both sexes, in the female specimen being 0.11 mm. long and five-sixths as wide, and in several males examined having approximately the same proportions. This area, in the male, is depressed and is surrounded anteriorly by a distinct rim, which fades out posteriorly; somewhat in front of the middle is the cleft, half as long as the whole area. The chitinous anal ring is close behind the genital area in the case of the male; in the female some distance posteriad.

Measurement of specimens:

	MALE	FEMALE
Body	0.508 mm.	approx. 0.555 mm.
Leg I	0.682 mm.	0.778 mm.
Leg II	0.749 mm.	0.850 mm.
Leg III	0.773 mm.	0.902 mm.
Leg IV	0.787 mm.	1.003 mm.
Palpus	0.336 mm.	0.365 mm.
Extreme breadth, genital area	0.326 mm.	0.317 mm.
Length of same along median line	0.112 mm.	0.110 mm.

The color is given in field notes as "nearly transparent, with patches of dark sepia, and a red patch between the eyes, showing through beneath prominently; legs very pale greenish; eyes black."

The types are retained in the collection of the author; co-types have been deposited in the collection of the Zoological Laboratory, the University of Nebraska, and in the United States National Museum.

This species is one of the more common forms and a large number of specimens were collected at Charlevoix, Mich., in the summer of 1894; it was especially abundant in East Twin Lake, where about a hundred specimens, together with many larvae and nymphs, were collected. At Reed's Lake, near Grand Rapids, Mich., it was found commonly and many specimens collected August 11, 1896; July 14, 1897; July 23, 1898; and July 26, 1899,—altogether amounting to about fifty in number. July 27, 1898, thirty-six specimens were taken in Grand River, near Grand Rapids, and in addition a number of other specimens are in the author's collection procured at different localities about Grand Rapids in the summer of 1895. Several specimens were received from Mr. E. Foster, collected in a pond in Audubon Park, near New Orleans, La., August 11, 1901, and other specimens have been received from the Illinois State Laboratory of Natural History collected in the vicinity of Havana, Ill. The species thus seems to be not only widely diffused but an abundant species wherever found.

This species is the smallest of the group to which it belongs, though of about the same size as *C. tardus* Thon, *C. coacta* Koenike, *C. stellaris* (Kramer), and *C. pusilla* (Neuman), from all of which it is distinguished by marked structural peculiarities.

The name refers to the limited number of spines on the legs.

8. *Curvipes medius* n. sp.

A species characterized especially by the presence of two long papillae on the fourth palpal segment, side by side, and by the lunate genital plates, each with a total number of acetabula between thirty-five and forty.

Owing to the fact that the specimen was mounted before its specific characters were known and carefully examined, nothing can be said of the form of the body, it having been modified by dis-

tortion, nor of the character of the eyes and antenniform bristles. The body is approximately 1.1 mm. in length, and the surface shows a faint and irregular striation.

The mandible is 0.278 mm. long and roughly triangular, with a longer ventral margin which is wavy in outline. The ventro-posterior angle is blunt and the claw short, curved, and bluntly rounded at the tip. The serration is coarse and confined to the vicinity of the tip.

The palpus (pl. XXXI, fig. 31) is 0.564 mm. in length, and of the total length the different segments make up the following percentages: 10, 27, 14, 32, 17. Seg. 1 is nearly half as thick again as long, and seg. 2 quite thick, being nearly as thick as long, while in seg. 3 the dimensions are about equal. Seg. 4 is about equal in thickness at the two ends and somewhat dilated at the middle where its extreme thickness is a little less than one-third the total length. Seg. 5 is moderately slender and possesses a rather pointed tip, where it bears four curved claws. The two papillae on seg. 4 are nearly equal in length, opposite one another, and placed obliquely to the axis of the segment. The claw at the tip is shelf-like. The spines on segs. 2 and 3 are serrate, which is true of no other species examined.

The epimera resemble in form and relationship those of *C. rotundus*.

The legs are of moderate length, the first being about the length of the body. The segments are, in order of length, 5, 6, 4, 3, 2, 1, except that in III and IV, 4 exceeds 6. Segs. 4 and 5 of leg I possess each two long hairs; the corresponding segments on leg II, four and five; and the same segments on leg III, five and six respectively; while segs. 4 and 5 of leg IV possess each four swimming-hairs. The anterior margin of the fifth segment of each leg is more or less produced at the tip of the segment.

The genital area (pl. XXXI, fig. 30) exhibits a median elliptical portion flanked on either side by two plates which have a tongue-like outline and are somewhat longer than broad. They are not solid but enclose an irregular area in which are imbedded free in the wall of the body two or three acetabula in addition to thirty-six or thirty-seven borne on the plates themselves. The two plates do not meet along the posterior margin of the median area and bear along their posterior border a row of fine hairs, together with several at the anterior end and a few about the outer margin.

Measurement of the specimen gives the following figures:

Body (approximately).....	1.100 mm.
Leg I.....	1.104 mm.
Leg II.....	1.282 mm.
Leg III.....	1.329 mm.
Leg IV.....	1.459 mm.
Palpus.....	0.535 mm.
Total length of mandible.....	0.278 mm.
Length of genital cleft.....	0.216 mm.
Extreme breadth of genital area (approximately).....	0.550 mm.

The type is retained in the author's collection.

The single female specimen of this species was taken at High Island Harbor, northern Lake Michigan, August 18, 1894.

C. medius resembles *C. rotundus* and *C. disparilis* Koenike, but differs from either in the number of acetabula and in minor structural details.

The name refers to its position, in reference to details of structure, between *C. rotundus* and *C. disparilis*.

9. *Curvipes rotundus* (Kramer)

Nesaea rotundus Kramer, 79; 12, pl. I, fig. 6.

Curvipes rotundus Piersig, 97; 118; pl. IX, fig. 19.

Piona rotunda Piersig, 1901; 259.

The body of this species is broadly elliptical, evenly rounded anteriorly and posteriorly, and very high, its dorso-ventral diameter being equal to or slightly greater than the width. There is practically no constriction behind the eyes, and the body is highest just behind the middle. The surface is marked by fine wavy lines, and all chitinous structures are rather heavier than usual in this genus. The males are about 0.75 mm. long, the females about 0.9 mm.

The eyes are quite close together, the distance between them equaling one-fourth of the length of the body, and are slightly removed from the anterior margin. The antenniform bristles are slender, sharply-pointed, straight, and rather short.

The mandibles (pl. XXXII, fig. 40) are similar to those of *C. Reighardi* in general shape, but the dorsal margin is somewhat more markedly excavated. The claw is more strongly curved, its tip surpassing the level of the dorsal margin, while the serration on

the flexor margin is finer and occupies the outer half. The total length of the mandible in a specimen about 0.9 mm. long is 0.221 mm.

The length of the palpus (pl. XXXII, fig. 41) is somewhat less than one-half the total length of the body. The various segments form the following percentages of this length: 6, 27, 14, 36, 17. Seg. 1 is, as usual, broad; seg. 2 is slightly narrower than long with a convex extensor margin and a still more convex flexor margin; seg. 3 is wider than long; seg. 4 is rather narrow and slightly expanded in the middle and with the extensor margin slightly convex; while seg. 5 is markedly contracted before the tip, where it is about one-half the diameter that it is at the base. In the male the proportionate length of the segments is the same, but the palpi are relatively a little heavier and the papillae on seg. 4 more prominent. The two papillae on seg. 4 are about opposite and markedly elongated, equaling more than half the thickness of the segment and bearing short spines. The spur at the tip of this segment is very prominent, while seg. 5 bears not only the usual three claws at the tip, but also, close behind the claws, a short stiff hair on the extensor margin and another on the flexor.

The epimera cover a considerable portion of the ventral surface, being separated in the female by a moderate interval, and in the male being in close apposition.

The legs of this species show a considerable difference in length between the first and last, and all but the first exceed the body length. There is, in the female, on seg. I 4 one long slender hair at the tip and also one at the tip of seg. I 5; on leg II are two or three on the corresponding segments; seg. III 4 possesses four swimming-hairs, and seg. III 5, five; while the corresponding segments on leg IV possess the same number. The last segment of the anterior three legs in the female are broadly club-shaped, while the distal segment of the fourth leg of the same species is relatively small and slender. The claws are large, rather delicate, and the two outer points slender and sharp. The legs of the male are proportionately heavier than in the female and the distal segment, especially on leg I, shows a tendency to be curved ventrad. Seg. III 6 (pl. XXXII, fig. 43) is rather stout, broader at the base, slightly curved, and bears a claw which is long, straight, and sharp. The segment preceding this is considerably elongated. Seg. IV 4 shows

the characteristic form and possesses proximad of the excavation seven shorter and two longer spines, in the excavation on the flexor side one long spine, and distad of it two spines on the posterior surface and one on the flexor margin, together with three swimming-hairs at the tip and one spine toward the extensor margin from them. Segs. III 4 and IV 5 each bears four swimming-hairs.

Each half of the genital area in the female (pl. XXXII, fig. 42) is longer and more pointed than in *C. Reighardi*, while the lunate plate is not only heavier but broader, and the acetabula cover less of its surface. There are in this sex from twenty-two to twenty-six acetabula on each side, of which three or four are imbedded free in the body wall; there are six spines at the anterior end of the plate, several scattered along the outer margin, and four or five at the posterior end. In the male this genital area is similar in form with a shorter genital cleft, at the bottom of a shallow depression and surrounded on all sides by an even margin, while the tongue-shaped chitinous plates contain each thirty or more acetabula. These plates are fused anteriorly in this sex with the inner end of the fourth epimeron. The anal opening is also surrounded by a relatively heavy chitinous ring and is situated close behind the genital area.

Measurements of typical specimens are as follows:

	MALE	FEMALE
Body, approximate		0.900 mm.
Leg I.....	0.629 mm.	0.854 mm.
Leg II	0.701 mm.	0.907 mm.
Leg III	0.710 mm.	0.965 mm.
Leg IV.....	0.782 mm.	1.027 mm.
Palpus	0.331 mm.	0.413 mm.
Genital cleft.....		0.182 mm.
Breadth of genital area.....		0.384 mm.

No notes at hand show what the original color of this species was. The legs and the epimeral plates, however, have retained a deep blue tint, while the eyes are black.

This species has been collected in the following localities in Michigan: Reed's Lake, Grand Rapids, during the summer of 1895 and on August 11, 1896; Grand River, near the same city, July 27, 1898; at "26" Lake, near Charlevoix, August 6, 1894; at High Island Harbor, northern Lake Michigan, August 18, 1894; and in the Kawkawlin River, during August, 1895 (J. B. Shearer). Specimens are also at hand from South Bend, Neb., collected September 1, 1897

(H. B. Ward). The number of specimens thus secured is twenty.

This species is referred to *C. rotundus* since, though it differs in certain details from the descriptions given by Piersig and from specimens received from Koenike, comparison of various references with the specimens named shows a great variability, within the limits of which all differences presented by our specimens fall. *C. guatemalensis* (Stoll) (87; 11, pl. X, fig. 2, pl. XI, fig. 1) and *C. clathratus* Koenike (93; 33, pl. III, figs. 26-29) are both closely related, but the differences have been so clearly defined by Koenike (95*b*; 209) that a repetition is quite unnecessary. The former is recorded from Central America and Canada, the latter from Zanzibar.

10. *Curvipes debilis* n. sp.

A species distinguished by the slenderness of the palpi and the characters of the genital area.

The single male specimen upon which this species is based is 0.841 mm. in length and 0.698 mm. in width. The body is evenly elliptical, the surface with the usual lines and the eyes very large and black and moderately wide apart, the distance between them being 0.214 mm. The antenniform bristles are short and straight and separated from one another by 0.198 mm.

The palpus (pl. XXXII, fig. 45) is slender, being no thicker than the basal segment of the first pair of legs and short, the different segments furnishing the following percentages of the total length: 9, 28, 19, 35, 9. The usual number of spines and hairs is present, except for the addition of a long, slender hair springing from the base of seg. 5 on the outer side. The two papillae on seg. 4 are side by side and both rather short, and at a distance from the base of the segment equal to three-fourths its length.

The epimera are separated by an interval unusually wide for a male specimen.

The legs are more than the average length, the first exceeding the body about one-seventh, the others correspondingly longer. The length of the segments in order is 5, 6, 4, 3, 2, 1, except in the case of leg III, where 6 is so shortened as to be even shorter than 3. Segs. 4 and 5 of the anterior legs are straight along the extensor margin but convex on the flexor side, while seg. 6 is slender. The following hairs are present: On segs. I 4 and I 5, three and four,

and on segs. II 4 and II 5, respectively, five and six slender hairs; on seg. III 3 are two; on seg. III 4, nine; and on III 5, one; while segs. IV 4 and IV 5 bear respectively four and six swimming-hairs. Seg. III 6 (pl. XXXII, fig. 44) is slightly curved toward the flexor side, is terminated by a long, sharp, straight claw, and bears unusually long hairs. Seg. IV 4 possesses proximad of the excavation on the posterior surface five short and two longer hairs, in the excavation one long hair, and distad of the same two short, flat hairs leading to the row of four swimming-hairs.

The genital area (pl. XXXII, fig. 46) is not large, its extreme breadth being only 0.294 mm. and its length, along the median line, 0.127 mm. The central shallow depression is nearly circular and bounded by tongue-shaped plates, in which are deeply imbedded fifteen acetabula on one side, and eighteen on the other.

Anal opening free in the body wall a short distance behind the genital area.

The following are the measurements of the specimen:

Body.....	0.841 mm.
Leg I.....	0.970 mm.
Leg II.....	1.051 mm.
Leg III.....	1.018 mm.
Leg IV.....	1.099 mm.
Palpus	0.355 mm.

Type retained by the author.

A single male specimen, collected in Cranberry Lake, Woods Hole, Mass., at the beginning of August, 1900.

The name is in allusion to the weakness of the legs.

II. *Curvipes Reighardi* n. sp.

A species of medium size, most closely related to *C. obturbans* Piersig and *C. tardus* Thon, and characterized by the form of the palpi and the characters of the genital area.

FEMALE.—The body is broadly oval in form and widest about two-thirds the length back from the anterior end. It is smoothly rounded posteriorly with a shallow indentation anteriorly between the eyes, is moderately high, and shows a very slight constriction posterior to the eyes. Its width is approximately three-fourths its length, which itself varies much, the smallest of a considerable number measured being 0.7 mm. long, the largest 1.1 mm., while the average was about 0.9 mm. The surface shows a faint striation.

The antenniform bristles are short and straight and separated by an interval somewhat less than that between the eyes. The latter are of medium size, close to the anterior margin and separated by a moderate interval. In a specimen 1.06 mm. long and 0.857 mm. wide the distance between the eyes was found to be 0.238 mm. and between the antenniform bristles 0.206 mm.

The maxillary shield is broad, evenly rounded posteriorly, and with the lateral margin forming an even curve with the lateral margin of the ancoral process, which is somewhat less than it in length, is moderately contracted posteriorly, and is broadly expanded at the tip. The mandibles (pl. XXXII, fig. 38) are of moderate size, the dorsal margin straight, the posterior margin slightly sinuate and about the same length as the dorsal, and the ventral somewhat longer and slightly concave. The ventro-posterior angle is produced into a long, sharp point, while that between the dorsal and posterior margins is a little greater than a right angle. The claw is broad, rather blunt, and only slightly curved, the tip not reaching by considerable the level of the dorsal margin; the flexor margin at the tip and along the outer edge bears about six short teeth.

The total length of the palpus (pl. XXXII, fig. 36) is slightly less than half that of the body, the different segments, from the base out, contributing the following percentages of the whole: 7, 26, 15, 34, 18. The flexor margin of the basal segment is nearly straight; both margins of 2 are convex, the maximum thickness of the segment being equal to its length; the extensor margin of 3 is considerably longer than the flexor; seg. 4 is slightly curved ventrad and tapers gradually from base to tip, the flexor margin only becoming slightly convex at the base of the papillae; while the terminal segment also tapers to a blunt tip which bears three claws, of which the middle one alone is curved. The spines on 2 and 3 show no trace of serration. The papillae on seg. 4, which are nearly opposite, are placed a little over one-half the distance from the base to the tip; both are short, but the outer is the longer, being equal in length to one-fourth the thickness of the segment; each bears a small hair. The spur at the tip of the flexor margin of this segment is small; there are also two or three small hairs on the inner surface of the segment.

The epimera (pl. XXXII, fig. 35) are separated by a considerable interval. Ep. III and IV possess an inner margin equal in length to about one-fifth of the total length of the body, while the

distance between those of opposite sides is about two-fifths the length of this margin. The projecting angle on the posterior margin of ep. IV is moderately long and sharp, the margin within it being concave, that external to it straight.

The legs are of moderate length and thickness, the first being somewhat longer than the body and the others slightly increasing in length from before backward. Seg. IV 5 is proportionally rather slender, and IV 6 markedly so. Seg. 3 of each leg is broadest in the middle where, on the flexor surface, it bears two heavy spines. On the posterior surface of seg. I 4 is a single small, slender hair, while on the next segment are two similar fine hairs; on seg. II 4 are two or three such hairs, and on seg. II 5 are three or four. Of true swimming-hairs seg. III 4 possesses three or four, while seg. III 5 possesses five or six, of which about four are in a line at the tip of the posterior margin, while the other one or two are separated by a little interval from it but are still in line with the rest. On the corresponding segments of leg IV are three and four swimming-hairs respectively. The claws are large and of the typical form (pl. XXXI, fig. 34).

The genital area (pl. XXXII, figs. 35 and 37) possesses a length along the median line equal to a little less than one-fourth that of the body and a breadth two-thirds greater than its length. The two flaps together form a broad elliptical area which is flanked on either side by a chitinous plate of the lunate form characteristic of the group to which this species belongs. On this plate are borne usually from 21 to 23 acetabula, while within the space it encloses there are, imbedded in the surface of the body, from two to four additional, of which one is larger than the rest. There is considerable variation in the number of acetabula, the specimen possessing the fewest having, on the two sides, 14 and 3 and 18 and 3 respectively. The specimen referred to also shows a division of the right plate into two. At the anterior end of this plate are from five to seven hairs and at the posterior end three or four, while about the circumference are scattered still three or four similar hairs. The anal opening lies isolated at a distance posterior to the genital area equal to about the length of this area.

The measurement of an average individual gives the following figures:

Body (approximately).....	0.825 mm.
Leg I.....	0.883 mm.
Leg II.....	0.946 mm.
Leg III.....	0.984 mm.
Leg IV.....	1.104 mm.
Palpus.....	0.403 mm.
Length of genital cleft	0.206 mm.
Total breadth of genital area.....	0.349 mm.

MALE.—It is very peculiar that among 110 specimens of this species collected from a wide range of localities there should have been found but one male and this, unfortunately, is in poor condition, having been preserved in Flemming's solution along with other species, and having suffered the breakage of all appendages except one palpus, while the fragments which remain are so mixed with those from other specimens as to make it impossible to recognize them with certainty. As near as can be told from the specimen in the condition in which it now is, the form of the body, the form of the palpus, and the relative proportion of parts are about the same as those given for the female. Its length is approximately 0.6 mm. The greater portion of the ventral surface is covered by the epimera, all of which are in apposition. The lateral margins of the genital area are about even with the tip of the process in the posterior margin of ep. IV. The genital cleft is long, extending throughout the entire length of this genital area, and the seminal pouch is in the form of a shallow elliptical depression of the same length. The chitinous plates on either side bear each about 35 acetabula.

The color of specimens of this species collected from Lake St. Clair was recorded in field notes as "nearly transparent with a slight bluish green tinge; with brown patches and a yellow Y-shaped dorsal point; eyes black; and legs bluish green." In specimens from Lake St. Clair and from High Island Harbor in northern Lake Michigan, as well as others from Havana, Ill., preserved in the proper mixtures, the blue color of the legs has been retained, but in specimens from other localities the color is gone, and hence no statement can be made as to whether this coloration holds true in all cases or not.

The types are retained in the author's collection; co-types have been deposited in the collection of the Zoological Laboratory, the University of Nebraska, and in the United States National Museum.

Of this species the collection contains one male and 109 females, representing altogether the following list of localities:

MICHIGAN.—Lake St. Clair, summer of 1893 (the one male was taken September 8). Intermediate Lake, Ellsworth, August 9, 1894 (C. D. Marsh). Round, Pine, and "26" Lakes, Charlevoix, summer of 1894. High Island Harbor, northern Lake Michigan, August 18, 1894. Grand River, Reed's Lake, and other small lakes in the vicinity of Grand Rapids, on various days during July and August of the years 1895, 1896, 1897, 1898, and 1899. Kawkawlin River, August, 1895 (J. B. Shearer).

ILLINOIS.—Illinois River, slough (Station "I"), and Quiver Lake (Station "C"), near Havana, May 10, 1895, June 25, 1896, August 9, 1895, and September 12, 1894 (Biological Station, Illinois State Laboratory of Natural History).

LOUISIANA.—Audubon Park, New Orleans, August 11, 1901 (E. Foster).

This species, the first water-mite collected by the author, is dedicated to Prof. J. E. Reighard of the University of Michigan, the most prominent American limnologist, to whose kindness he owed the opportunities which put him in possession of his first specimens, the attractiveness of which led to his beginning the study of the group. The previous dedication of a genus of pentastomids to Professor Reighard has prevented the author from acknowledging in a more fitting manner his indebtedness to him.

It resembles *C. obturbans* Piersig, but differs in the greater stoutness of the palpi, especially of seg. 2, in the more uniform tapering of seg. 4 from base to tip, and in the absence of the small hair-bearing papillae on seg. 4, distad of the two usual prominent ones, which themselves are nearer the base of the segment. The genital area is similar and in *C. Reighardi* is very variable in the number of acetabula it possesses, yet it shows evident, though slight, differences in form and proportions. From *C. tardus* Thon this species is more easily distinguished by its shorter palpi, which are of different proportions, by the interval between the epimeral masses, and by the larger size and details of structure of the genital area.

12. *Curvipes obturbans* Piersig

Curvipes obturbans Piersig, 96; 439: Piersig, 97; 135, pl. X, fig. 23.

Piona obturbans Piersig, 1901; 259.

This species, of which only two females have been secured, is so close to the preceding that it can best be described by making a direct comparison. It is rather more pyriform than oval, and the greatest width of the body is somewhat farther back than in *C. Reighardi*. The eyes are larger but are separated by about the same distance from one another, while the antenniform bristles are also similar in size and position. The epimeral plates and the maxillary shield are similar in form although the latter is somewhat broader and shorter. The chief differences which distinguish these two females from those of the other species are the characters of the palpi, the length and details of structure of the legs, and the details of the genital area.

The palpus in this species (pl. XXXII, fig. 39) is somewhat more than one-half the length of the body instead of somewhat less, and the figures representing the percentage length of the segments are, in the same order as given for the preceding species: 8, 29, 17, 31, 15. Seg. 2 is but little more than two-thirds as thick as long; seg. 3 four-fifths as thick as long; while seg. 4 is much more nearly of uniform thickness from base to tip, the two ends being as 9 to 7. Seg. 5 is also somewhat heavier than in the other species though as a whole the palpi are seen to be distinctly longer and slenderer. The flexor margin of seg. 1 is plainly angulated. On seg. 4 the usual two papillae are accompanied by two very small, hair-bearing papillae, placed just distad of them.

The legs of this form are relatively longer than in the other species and the anterior legs proportionately much longer, thus leaving less difference between the first and last. In length of individual segments 4, 5, and 6 of all the legs are increased proportionately, and these segments of legs I and II greatly, so that they become nearly as long as the corresponding segments of legs III and IV. In legs III and IV, segs. 5 and 6 are approximately equal, whereas in the other species 6 is noticeably shortened. The hairs on the legs are more numerous on segs. I 4 and I 5, there being three and five slender hairs respectively and on the corresponding segments of II, seven each, with one on 3; while segs. 3, 4, and 5 of legs III and

IV have three, nine, and nine, and three, seven, and five respectively. Those on 4 and 5 of these legs are swimming-hairs.

Measurements of a mounted specimen give the following results :

Body (approximately).....	0.800 mm.
Leg I.....	0.984 mm.
Leg II.....	1.090 mm.
Leg III.....	1.123 mm.
Leg IV.....	1.147 mm.
Palpus	0.432 mm.

The genital area in this species is relatively smaller than in *C. Reighardi* and the chitinous lunate plates flanking the genital flaps still smaller in proportion. Each bears from 15 to 18 acetabula while two more are imbedded in the surface of the body, and there are the usual small hairs, about six at the anterior end, five at the posterior, and about three along the outer margin.

Of this species only two specimens are at hand, both of which were received from Mr. E. Foster of New Orleans, La., who collected them in a pond at Slidell, in the same state, October 19, 1901. From a trace of color still remaining I am led to infer that the mites were red during life.

This species is referred to *C. obturbans* because of the perfect agreement in palpal characters, the difference in number of acetabula being negligible, in view of the variation in allied species. The greater number of hairs on the legs seems to distinguish this species clearly from *C. Reighardi*; it is unfortunate that data concerning the same character are not obtainable for *C. obturbans*, as found in Saxony and Great Britain, the two localities from which it has hitherto been reported.

13. *Curvipes inconstans* n. sp.

A species characterized by the characters of the palpi and genital area.

The body of this form is evenly elliptical, about one-fourth as wide as long and five-sevenths as high. The measurement of different specimens gave lengths varying from 0.793 mm. in the case of a specimen from Columbia, Mo., to 1.111 mm. in the case of another from High Island Harbor, northern Lake Michigan. The surface is marked by fine, inconspicuous striae. The distance between the

eyes varies in different specimens from somewhat over one-fourth to nearly one-third the width of the body. The antenniform bristles are very short and straight.

The maxillary shield is broad and short with a broad ancoral process. The mandibles are considerably produced ventro-posteriorly with the dorso-posterior angle rounded and a claw of moderate length and thickness. Serrations few and low, at the tip.

The palpus (pl. XXXII, fig. 47) is relatively short, being less than half the total length. The following figures represent the percentage of each of the segments: 9, 28, 14, 31, 18. The palpi are relatively slender, the second segment somewhat less thick than long, the third segment one-third thicker than long, the fourth somewhat less than one-third as broad at the base as its length, and tapering gradually to the tip. The fifth segment is relatively long, slender, and very narrow at the outer extremity, where it bears three claws, which are proportionately long. The papillae on the flexor surface of seg. 4 are small, with the outer the larger, almost opposite, and at about the middle of the segment. The spur at the tip is very small.

The angle on the posterior margin of ep. IV is rather short (pl. XXXIII, fig. 49). The legs are only of moderate length, the first being shorter than the body and the second of about the same length, while the two posterior are still longer. They bear few spines, while the claws are relatively large and the points long and slender. Seg. I 4 bears in some specimens a single fine hair and I 5 one or two; segs. II 4 and II 5 bear two and three respectively; segs. III 4 and III 5 three and four long hairs; while segs. IV 4 and IV 5 possess three and four swimming-hairs respectively.

The genital area (pl. XXXIII, figs. 48 to 50) is characterized by the length of the genital cleft and the possession of several chitinous plates bearing acetabula, the number of both varying. The plates are two or three, the acetabula from eleven to eighteen. There is always an anterior plate with two or three acetabula and about six hairs at the anterior end, a posterior transverse plate with seven to twelve acetabula, and several hairs at the inner end, and besides from one to three acetabula are imbedded free in the body wall or surrounded by a small plate of chitin. All the chitin occupies the position which would result from the breaking up of a single lunate plate on each side.

Measurement of a mounted specimen gives the following figures :

Body (approximate)	0.800 mm.
Leg I	0.737 mm.
Leg II.....	0.818 mm.
Leg III.....	0.864 mm.
Leg IV.....	0.974 mm.
Palpus	0.355 mm.

Types of this species are retained in the collection of the author and co-types are also deposited in the collection of the Zoological Laboratory, the University of Nebraska, and in the United States National Museum.

This species, of which only females have been taken, has been collected at the following localities : Four specimens at Cranberry Lake, Woods Hole, Mass., at the beginning of August, 1900; one specimen at High Island Harbor, northern Lake Michigan, August 18, 1894; three specimens from ponds at Columbia Mo., August, 1901; five specimens at Circle Lake, Decatur, Neb., June 7, 1899 (Charles Fordyce); six at Slidell, La., August 18, 1901, and October 19, 1901 (E. Foster); also six from a pond in Audubon Park, New Orleans, La., August 11 and October 13, 1901 (E. Foster); and specimens have also been received from the Illinois State Laboratory of Natural History collected near Havana, Ill.

The name refers to the variability of the species in regard to the character of the genital area, hardly two specimens agreeing in this regard. It is similar in certain respects to *C. rufus* (Koch), *C. pauciporus* Thor, and *C. circularis* Piersig, but comparison seems to show it quite distinct.

14. *Curvipes setiger* n. sp.

A species characterized by the form and structure of the genital area and by the very long antenniform bristles.

This species is of an elongated elliptical form with a depression between the eyes and a very slight constriction behind them. The length of the single male in the collection is 0.698 mm., its width 0.540 mm. The females vary from 1.022 mm. to 1.095 mm. in length, the average being 1.063 mm., while the average width is about three-fourths of the length. The surface is finely striate.

The antenniform bristles are extremely long, being in the single male 79 μ in length and in one female measured 103 μ long. They

are slender, sharply pointed, and slightly curved upward. The distance between them is about five-sixths of that between the eyes. These latter are large and only a trifle over one-third as far apart as the body is wide.

The palpi are rather short, being noticeably less than half as long as the body. The percentage of length of the segments is as follows: 10, 28.5, 14, 33.5, 14. In the male (pl. XXXIII, fig. 54) the flexor margin of seg. 2 is nearly straight and the extensor convex, while seg. 4 is considerably dilated. The papillae on seg. 4 in the male are six in number, the two nearest the base being the longer, the shortest pair situated farthest distad. Each of the six bears a hair which in the case of the longer papillae is inserted, not at the tip, but below and behind it. The fifth segment is curved ventrad and is squarely truncate at the tip, where it bears three claws. The palpus of the female (pl. XXXIII, fig. 52) is similar to that of the male except that seg. 4 tapers nearly uniformly from the base to the tip and the papillae are very small and two in number. The hairs they bear are situated in a position similar to that of those of the male.

The two anterior pairs of epimera in the male are wide apart, the other two pairs in close apposition, the length of the inner margin of the two latter combined being 0.174 mm. In the female the two posterior pair of epimera are separated by a considerable space. The legs are of medium length in the male, the first being approximately the length of the body, the others exceeding it, while in the female both I and II are shorter than the length of the body, III is equal to it, and IV but slightly exceeds it. The different segments are in length, in the case of the female and in order beginning with the longest, 6, 5, 4, 3, 2, 1, except in the fourth leg where both 5 and 4 exceed 6. In the male the order is the same except that in leg III segs. 5 and 4 both exceed 6. In the female there are on segs. I 4 and I 5 two very fine hairs; on segs. II 4 and II 5, four or five and eight respectively; on seg. III 3 three long hairs, and on III 4 and III 5, seven or eight and ten swimming-hairs; while on seg. IV 4 and IV 5 are six and nine swimming-hairs respectively. In the case of the male practically the same number of long hairs are found on the first two legs, but only one or two on seg. III 3, and no swimming-hairs on segs. III 4 and III 5, while on segs. IV 4 and IV 5 are three and nine swimming-hairs respectively. Seg. III 6 of the

male (pl. XXXIII, fig. 53) is of about uniform thickness throughout, is curved ventrad, is squarely truncate, and has a small claw on the extensor side. Seg. IV 4 (pl. XXXIII, fig. 55) possesses numerous spines proximad of the excavation, one on the extensor and three toward the flexor side within it, and a row of four coarse spines distad of it, together with the three swimming-hairs. The tip of the segment is strongly produced.

The genital area of the male (pl. XXXIII, fig. 51) presents a seminal receptacle broadly elliptical in form with the longest diameter transverse. On either side this is flanked by a plate which is nearly straight along the anterior margin, somewhat convex along the posterior margin, of nearly uniform width, and squarely truncate at the tip. It bears about eleven acetabula. The genital area of the female (pl. XXXIII, fig. 56) exhibits an elliptical median area flanked by two or three chitinous plates arranged in an irregular manner, but occupying such a relationship to one another as would be a result of the breaking apart of a lunate plate of a form similar to that characteristic of the group to which *C. rotundus* belongs. The anterior of these plates bears one or two acetabula and about eight hairs in a row around the anterior margin. Behind this is in some specimens a plate bearing one or two acetabula, while still further posteriad is a plate transversely placed bearing about eight or ten acetabula. There is also, as a rule, a large acetabulum situated within an excavation at the posterior end of the last plate, making a total altogether of from nine to twelve acetabula.

Measurement of specimens gives the following figures:

	MALE	FEMALE
Body.....	0.698 mm.	1.066 mm.
Leg I.....	0.696 mm.	0.921 mm.
Leg II.....	0.787 mm.	1.008 mm.
Leg III.....	0.734 mm.	1.070 mm.
Leg IV.....	0.787 mm.	1.133 mm.
Palpus.....	0.336 mm.	0.408 mm.

The types of this species are retained by the author and co-types of female specimens deposited in the collection of the Zoological Laboratory, University of Nebraska, and in the United States National Museum.

C. setiger has been collected in only one locality, a spring-fed pool in Monroe Canyon, Sioux County, Neb., May 28, 1899, where one male and ten females were taken.

The name is given in allusion to the length of the antenniform bristles, which exceed by considerable not only that of any other of our American species but that of any other species hitherto discovered.

It closely resembles at first *C. inconstans* but differs in the following particulars: The antenniform bristles, as just stated, are very much longer; the proportionate lengths of the segments of the palpi and the character of the fourth segment are both different; the number of swimming-hairs on the legs is much greater; the relative lengths of the segments of the legs is also much different; while, in the case of the genital area, although the number of acetabula is not diagnostic, the character of the chitinous plate that bears them is different. The species resembles the same three European species referred to in connection with *C. inconstans*, but seems entirely distinct, on comparison of details of structure.

15. *Curvipes crassus* n. sp.

A heavily built species with very marked structural features.

From the examination of four males and a single female of this species the form appears to be elliptical, with a moderate flattening between the eyes. The cuticula is very thick and marked by numerous close raised ridges which are of uneven height, so that in oblique view the surface looks almost as if covered with evenly distributed, low papillae. Of the four males the longest is 0.635 mm. in length and 0.508 mm. in width, the average being 0.605 mm. and 0.518 mm. respectively. The female is 0.793 mm. long and 0.659 mm. wide. The body is moderately high and quite evenly convex dorsally. There is below and slightly within each eye a flattened, blade-like antenniform bristle of considerable length arising from a low papilla; in the largest male referred to above it is 30 μ long. The eyes are large, near to the margin, and separated by a distance equal to a little less than one-third the average breadth of the body.

The maxillary shield is unusually narrow and the ancral process relatively short and strongly hooked. The mandibles are rather broad, expanded posteriorly, and with a rounded angle between the dorsal and posterior margins, while the claw is relatively small and angulated, tapers to a slender but blunt point, and shows no serration.

The palpi (pl. XXXIII, figs. 59 and 60) are stout, heavily chit-

inised, and very characteristic in form, with a total length a little less than half that of the body. The following numbers represent the percentage lengths of the segments: 10, 31, 16, 27, 16. Seg. 1 is not quite twice as broad as long; seg. 2 is about the same in thickness as in length; seg. 3 is somewhat thicker than long; and seg. 5 is rather narrow at the base, where it is less than half as wide as long, and tapers to a tip equal in width to about one-fourth the length, and which bears three small distal claws. Seg. 4 is strikingly modified, a very prominent projection of its ventral margin bringing the distal portion of this margin almost in line with the distal end of the segment and at a right angle with the proximal portion. The diameter of the segment at the distal end becomes thus nearly twice that at its base and equal to three-fourths its total length. On this distal portion of the flexor margin are placed three pairs of blunt conical papillae, and outside the line of these, between the first two proximal pairs, is another papilla on either side, making eight altogether. All of these papillae bear hairs, which are on the two proximal ones moderately long, on the rest short and slender. The palpus of the female is similar to that of the male in size and proportions of segments, but the distal portion of the flexor margin of 4 bears only two pairs of papillae, each one with a short hair. The claw at the distal end of this margin is in both sexes represented simply by a blunt projection.

The epimera in the male are all in contact except that between the inner ends of the first two pairs is a small area not covered by them. Over the epimera are seen coarse parallel striae. The process on the posterior margin of ep. 4 is very long and sharply pointed. In the female the epimera are similar in form but the four groups are separated by a narrow interval.

The legs are rather short, the first pair in the male being only slightly shorter than the body and the others all exceeding it, while in the female the last two exceed the length of the body; they are rather stout, the chitinous covering being here, as elsewhere, much thickened. In leg IV the four basal segments are much stouter proportionately than the others. The segments increase in length also from the base outward, though in the male 6 is shortened so that it is shorter than 4 and in leg IV it is still exceeded by 5, while in the female the same is true in legs III and IV. In legs I and II seg. 5 has a convex flexor margin and seg. 6 is very markedly expanded at

the tip (pl. XXXIII, fig. 57), while the spines are few. Segs. 4 and 5 also show a distal expansion on the anterior side. In leg III of the male (pl. XXXIII, fig. 58), 5 is narrow at the base and dilated at the distal end, while 6 is very short, squarely truncate at the end, its flexor margin straight and its extensor margin strongly convex at the base, beyond which it is parallel to the flexor. The claw is small and straight. In leg IV of the male segs. 5 and 6 are noticeably slender in contrast to the marked dilatation of the basal four segments, already referred to, and seg. 6 is slightly dilated toward the tip. The same dilatation of the distal segment characterizes the legs of the female, though it is in much less marked degree. Seg. 4 of this leg is broadly expanded and with a deep excavation on the posterior surface, proximad of which are many stout spines, and distad of which is a row of three short, stout spines, two swimming-hairs, and a very heavy spine at the tip on the flexor side. In the male are three long hairs in a row at the tip of seg. II 5, one at the end of seg. III 4, the two swimming-hairs on IV 4, and six on IV 5; while in the female seg. I 5 bears one slender hair, seg. II 5 four swimming-hairs, segs. III 4 and III 5 two and five swimming-hairs, and segs. IV 4 and IV 5 three and five respectively.

The genital area is in close contact with the posterior epimeron in the male and extends around on the outer portion of the angle on the posterior surface to beyond the outer end of the epimeron. There is no seminal receptacle and the genital cleft is very short, being $41\ \mu$ long. In the female the two genital flaps form a broadly elliptical area, from the posterior half of either lateral margin of which project two long tongue-like chitinous plates which are concave on the anterior and convex on the posterior margin and which extend to beyond the line of the angle on the fourth epimeron, while there are also one or two acetabula at the margin of the median area and midway between these plates and the anterior end of the area. Each plate flanking the genital area of the male bears 50 to 60 acetabula; in the case of the female over 70.

Measurements of specimens:

	MALE	FEMALE
Body.....	0.659 mm.	0.793 mm.
Leg I.....	0.619 mm.	0.682 mm.
Leg II.....	0.682 mm.	0.754 mm.
Leg III.....	0.749 mm.	0.830 mm.
Leg IV.....	0.840 mm.	1.042 mm.
Palpus.....	0.360 mm.	0.365 mm.

The color of specimens collected in Susan Lake, near Charlevoix, Mich., was noted in field notes as follows: "Body tinged posteriorly and around margin with bluish green, most pronounced at the posterior end. Anterior median portion strongly tinged with dull reddish. Eyes black. Legs a bright bluish green with terminal joints brownish."

Types retained in the author's collection.

This very characteristic species has been collected in the following localities in Michigan: Near Grand Rapids, in the summer of 1885, two males; at Lamberton Lake, near Grand Rapids, July 4, 1900, one female; at Susan Lake, near Charlevoix, August 21, 1894, three males.

This species is similar to no other species of *Curvipes* except *C. thoracifer* Piersig, from which it differs, however, in all details of structure, including the characters of the palpi, the space between the epimera, the number of acetabula, the form of the genital plates in the female, etc.

The name has reference to the strength of the chitinous covering and the stoutness of the appendages.

III. TABLE FOR THE DETERMINATION OF THE ABOVE SPECIES

FEMALES

1. Acetabula imbedded free in the wall of the body.....1. *C. coronis*
Acetabula in part or all on chitinous plates..... 2
2. Two genital plates, one on either side 3
More than one on each side.....12
3. The genital plate solid, its whole inner margin in contact with the median elliptical area..... 4
The genital plate lunate, enclosing an area in which a greater or less number of acetabula are imbedded free in the body wall..... 9
4. The distal segment of the legs strongly curved3. *C. pugilis*
The distal segment of the legs not curved..... 5
5. Acetabula numerous, 45 or 50..... 6
Acetabula fewer, not over 30..... 7
6. Palpus very long, nearly equaling the body in length and the fourth segment markedly contracted at the base.....2. *C. exilis*
Palpus not over half the length of the body, fourth segment tapering,
4. *C. turgidus*
7. Acetabula about ten, small, on a very short plate.....6. *C. constrictus*
Acetabula from twenty to thirty, large, on a plate longer than broad.... 8
8. The epimera confined to the anterior half of the ventral surface, body larger, and swimming-hairs on segs. IV 4 and IV 5, five and seven respectively5. *C. triangularis*

- The epimera covering most of the ventral surface, body very small, and swimming-hairs on segs. IV 4 and IV 5, four each7. *C. spinulosus*
9. Papillae on seg. 4 of the palpus long, equaling in length half the thickness of the segment or more.....10
Papillae on seg. 4 of the palpus short.....11
10. Acetabula numerous, 35 to 40 on each plate.....8. *C. medius*
Acetabula fewer, 22 to 26 on each plate.....9. *C. rotundus*
11. Swimming hairs fewer, on segs. III 4 and III 5 being three or four and five or six; and on IV 4 and IV 5, three and four; two papillae on fourth segment of palpus.....11. *C. Reighardi*
Swimming-hairs more numerous, being on the four segments named, nine, nine, seven, and five; two small papillae on fourth segment of palpus in addition to two above12. *C. obturbans*
12. Distal end of the fourth palpal segment much dilated, as also distal segments of legs; chitinous parts all coarse and heavy.. 15. *C. crassus*
Fourth palpal segment tapering, and all chitinous parts slighter.....13
13. Antenniform bristles of usual length; acetabula from eleven to eighteen; swimming-hairs on segs. IV 4 and IV 5, three and four respectively.....13. *C. inconstans*
Antenniform bristles very long; acetabula from nine to twelve; swimming-hairs on segs. IV 4 and IV 5, six and nine respectively...14. *C. setiger*

MALES

1. A seminal pouch or seminal receptacle present.....2
Simply a depression at the bottom of which is the genital opening.....4
2. Acetabula numerous, 40 to 50 in number.....4. *C. turgidus*
Acetabula few, from nine to eleven.....3
3. Several long, slender hairs on seg. III 5 and fifteen swimming-hairs on IV 5; two papillae on the fourth segment of the palpus; seg. III 6 cornucopia-shaped.....6. *C. constrictus*
No such hairs on seg. III 5 and only nine swimming-hairs on IV 5; six papillae on the fourth segment of the palpus; seg. III 6 slightly bent, not broader at the tip.....14. *C. setiger*
4. One claw at least on seg. III 6 long and straight.....5
Neither long and straight, but short and curved6.
5. Size small; papillae on the fourth segment of the palpus of medium length; swimming-hairs on IV 4 and IV 5, three and four respectively; acetabula 25 to 30.....7. *C. spinulosus*
Size medium; papillae on the fourth palpal segment long; swimming-hairs on as in the preceding; acetabula about 30.....9. *C. rotundus*
Size rather large; legs relatively weak; papillae on fourth palpal segment short; swimming-hairs on segs. IV 4 and IV 5 three and nine respectively; acetabula fifteen to eighteen.....10. *C. debilis*
6. Fourth palpal segment not greatly dilated at the distal end and with two papillae.....7
Fourth palpal segment greatly dilated at the tip and with eight papillae15. *C. crassus*

- In fitting the species described above into Piersig's table (1901: 244), the following changes become necessary:

4. Maxillary palpus much stronger than the basal segment of leg I; etc.,
2. *C. aduncopalpis*
Maxillary palpus little stronger than the basal segment of leg I; etc. 4a
4a. Acetabula scattered irregularly over a considerable area, sixteen to
twenty in number 3. *C. conglobatus*
Acetabula more closely collected into a group with circular outline,
twenty-three to twenty-eight in number *C. coronis*
8. Maxillary palpus small, etc. 8a
Maxillary palpus large, etc. 9
8a. Genital plate circular, bearing eighteen to twenty-four acetabula,
6. *C. carneus*
Genital plate very short, crowded against median area, bearing about
ten acetabula *C. constrictus*
9. With several large papillae, etc. 7. *C. uncatus*
With two large papillae and two very small ones beyond them, *C. turgidus*
With only two, etc. 10
13. Acetabula numerous, 45 or 50. 13a
Acetabula fewer, not over 30. 13c
13a. Distal segment of legs strongly curved. *C. pugilis*
Distal segment of legs not strongly curved. 13b
13b. Leg III shorter than leg II; palpus about half the body length,
11. *C. longipalpis*
Leg III longer than leg II; palpus nearly equaling the body in length,
C. exilis
13c. Size large, about 2 mm.; a group of hairs on the last epimeron, along
the outer portion of the posterior margin. 12. *C. nodatus*
Size medium or small; no such hairs. 13d
13d. Size medium, about 1 mm.; epimera confined to anterior half of ven-
tral surface. *C. triangularis*
Size small, not over 0.6 mm.; epimera covering most of ventral sur-
face *C. spinulosus*
20. Each genital plate with over 50 acetabula. 20. *C. disparilis*
Each genital plate with 35 to 40 acetabula. *C. medius*
Each genital plate with less than 30 acetabula 21
21. Papillae on the fourth segment of the palpus long. 21. *C. rotundus*
Papillae on the fourth segment of the palpus short. 21a
21a. Swimming-hairs fewer; two papillae on fourth palpal segment,
C. Reighardi

- Swimming-hairs more numerous; two small papillae additional on the fourth palpal segment.....22. *C. obturbans*
24. Posterior genital plates transverse, etc.....25
Posterior genital plates curved.....24a
- 24a. Total number of acetabula nine to twelve; anterior plates with none,
24. *C. pauciporus*
- Total number of acetabula eleven to eighteen; anterior plates with two or three.....*C. inconstans*
25. Posterior genital plates broad, etc.....25. *C. thoracifer*
Posterior genital plates narrow, etc.....26. *C. setaceus*
Posterior genital plates very long, relatively narrow; anterior plate with one or two acetabula.....*C. crassus*
27. Posterior genital plates as in *C. thoracifer*, etc.....28. *C. neumani*
Genital plates as in *C. rotundus*, etc.....29. *C. circularis*
Genital plates resembling those of *C. circularis*, but nine to twelve acetabula instead of thirteen to seventeen, and palpus different,
C. setiger

MALES

6. So-called anal opening very close to the genital area, etc.....6a
So-called anal opening distinctly behind the genital area, etc.,
3. *C. conglobatus*
- 6a. Distal segment of the legs markedly curved.....*C. pugilis*
Distal segment of the legs not markedly curved.....6b
- 6b. Acetabula eighteen to twenty-four on each plate.....22. *C. obturbans*
Acetabula 45 to 50 on each plate.....*C. exilis*
7. Each genital plate with 15 to 18 acetabula.....*C. debilis*
Each genital plate with 24 to 30 acetabula.....7a
Each genital plate with 45 to 60 acetabula.....20. *C. disparilis*
- 7a. Size small, about 0.5 mm.; papillae on fourth palpal segment of only medium length.....*C. spinulosus*
Size larger; papillae on fourth palpal segment long.....21. *C. rotundus*
10. Maxillary palpus with four or five larger papillae on the fourth segment.....7. *C. uncatatus*
Maxillary palpus with two large and two smaller papillae.... *C. turgidus*
Maxillary palpus only with two, etc.....11
15. Maxillary palpus as weak or weaker than the basal segment of the first pair of legs, etc.....15a
Maxillary palpus thicker than the basal segment of the first pair of legs, etc.....16
- 15a. Segment IV 4 with nine swimming-hairs on the distal end ..6. *C. carneus*
Segment IV 4 with only three swimming-hairs.....*C. constrictus*
16. Opening of the seminal pouch as in *C. carneus*.....16a
Opening of the seminal pouch forming a transversely placed ellipse,
28. *C. neumani*
- 16a. Papillae on the fourth segment of the palpus, six in number and opposite, in pairs; no long hair on seg. III 5, nor row of swimming-hairs.....*C. setiger*

- Larger papillae on fourth palpal segment oblique; four swimming-hairs and a very long hair at tip of III 5.....29. *C. circularis*
21. Genital plates of irregular, wing-like form, etc.....30. *C. coactus*
- Genital plates at the outer end rounded and broadly tongue-shaped....22
- Genital plates extended anteriorly about the outer end of the last epimeron*C. crassus*

BIBLIOGRAPHY

DUGÈS, ALF.

84. *Naturaleza Mèxico*, VI, 345, pl. VIII, figs. 10-19.

HERMANN, J. F.

04. *Mémoire aptérologique*. Strasbourg, 1804.

KOENIKE, F.

93. Die von Herrn Dr. F. Stuhlmann in Ostafrika gesammelten Hydrachniden des Hamburger naturhistorischen Museum, *Jahrb. Wiss. Anst. Hamburg*, X, 1893, 1-55, 3 pls.; also separate.
- 95b. Nordamerikanische Hydrachniden, *Abh. des Naturwiss. Ver. zu Bremen*, XIII, 1895, 167-226, pls. I-III; also separate.

KRAMER, P.

79. Neue Acariden, *Arch. f. naturgesch.*, XLV, 1879, 1-18, pls. I and II.

PIERSIG, RICH.

- 96a. Einige neue Hydrachniden-Formen, *Zool. Anz.*, XIX, 1896, 438-41.
97. Deutschlands Hydrachniden, *Bibl. Zool.*, XXII. Stuttgart, 1897-1900. 601 pp., 51 plates.

PIERSIG, RICH. [AND LOHMANN, H.]

1901. Hydrachnidae [and Halacaridae]. *Das Tierreich*, XIII. Berlin, June, 1901. pp. 336+XVIII, 87 text figs. (Hydrachnidae by Piersig.)

STOLL, OTTO.

87. Hydrachnidae, *Godman and Salvin's Biologia Centrali-Americana*, *Zool.*, part LIX, 1887, 9-15, pls. VII-XI.

Zoological Laboratory,
The University of Nebraska.

EXPLANATION OF PLATES

All drawings made from slides and with the camera, unless otherwise stated.

Plate XXIX

Figs. 1, 2. *C. coronis*

Fig. 1. Epimeral field and genital area, ♀; from an unmounted specimen; $\times 80$.

Fig. 2. Inner side of left palpus, ♀; $\times 135$.

Figs. 3-8. *C. exilis*

Fig. 3. Anterior surface of segment IV 4, ♂; $\times 260$.

Fig. 4. Palpus, from the inner and ventral aspect; ♀; $\times 135$.

Fig. 5. Genital area, ♀; from an unmounted specimen; $\times 110$.

Fig. 6. Claws of the mandibles, from ventral aspect, ♂; $\times 435$.

Fig. 7. Segment III 6, ♂; $\times 365$.

Fig. 8. Genital area, ♂; $\times 135$.

Figs. 9-12. *C. pugilis*

Fig. 9. Palpus, outer side, ♂; $\times 135$.

Fig. 10. Segment III 6, ♂; $\times 260$.

Fig. 11. Segments II 5 and II 6, ♂; from anterior side; $\times 135$.

Fig. 12. Genital area, ♂; $\times 135$.

Fig. 13. *C. constrictus*

Fig. 13. Segment III 6, ♂; $\times 135$.

Plate XXX

Figs. 14-18. *C. constrictus*

Fig. 14. Epimeral field and genital area, ♀; from the unmounted specimen from Wray, Colo.; $\times 110$.

Fig. 15. Epimeral field and genital area, ♂; from the unmounted specimen from Ann Arbor, Mich.; $\times 110$.

Fig. 16. Segments 4 to 6 of leg IV, ♂, from the anterior side; $\times 160$.

Fig. 17. Inner side, left palpus, ♂; $\times 260$.

Fig. 18. Posterior side, segments II 5 and II 6, ♂; $\times 160$.

Figs. 19-23. *C. turgidus*

Fig. 19. Posterior side, segment III 6, ♂; $\times 160$.

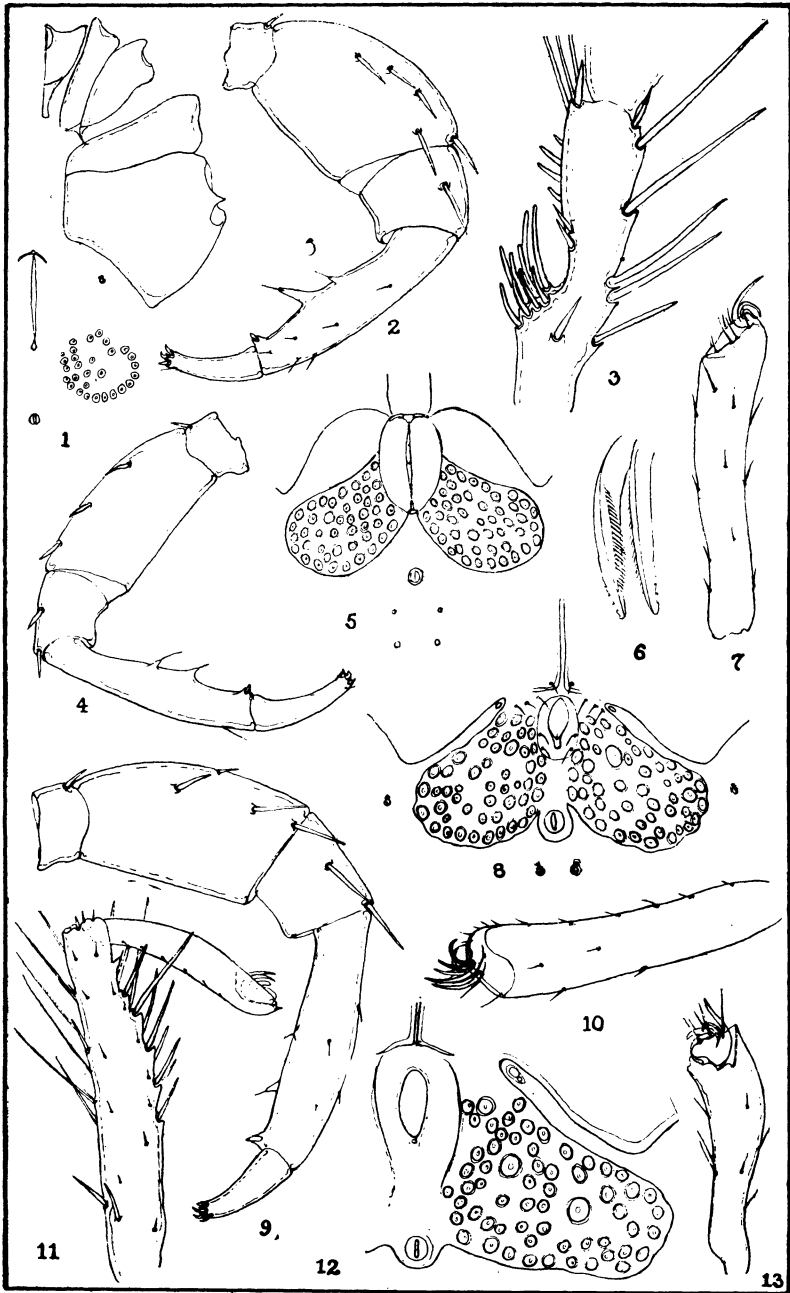
Fig. 20. Genital area, ♀; $\times 110$.

Fig. 21. Genital area, ♂; from an unmounted specimen from Oshkosh, Wis.; $\times 110$.

Fig. 22. Outer side of left palpus, ♀; $\times 125$.

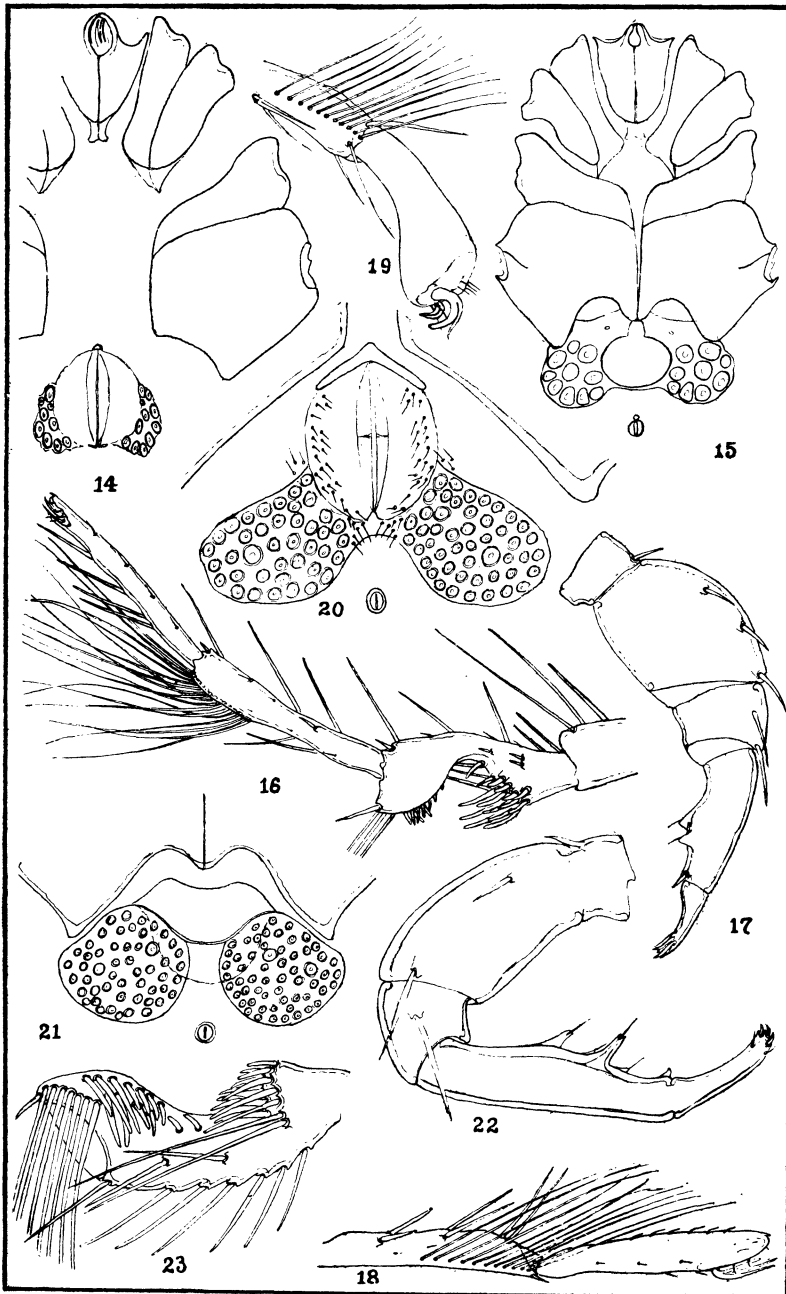
Fig. 23. Posterior surface, segment IV 4, ♂; $\times 160$.

PLATE XXIX



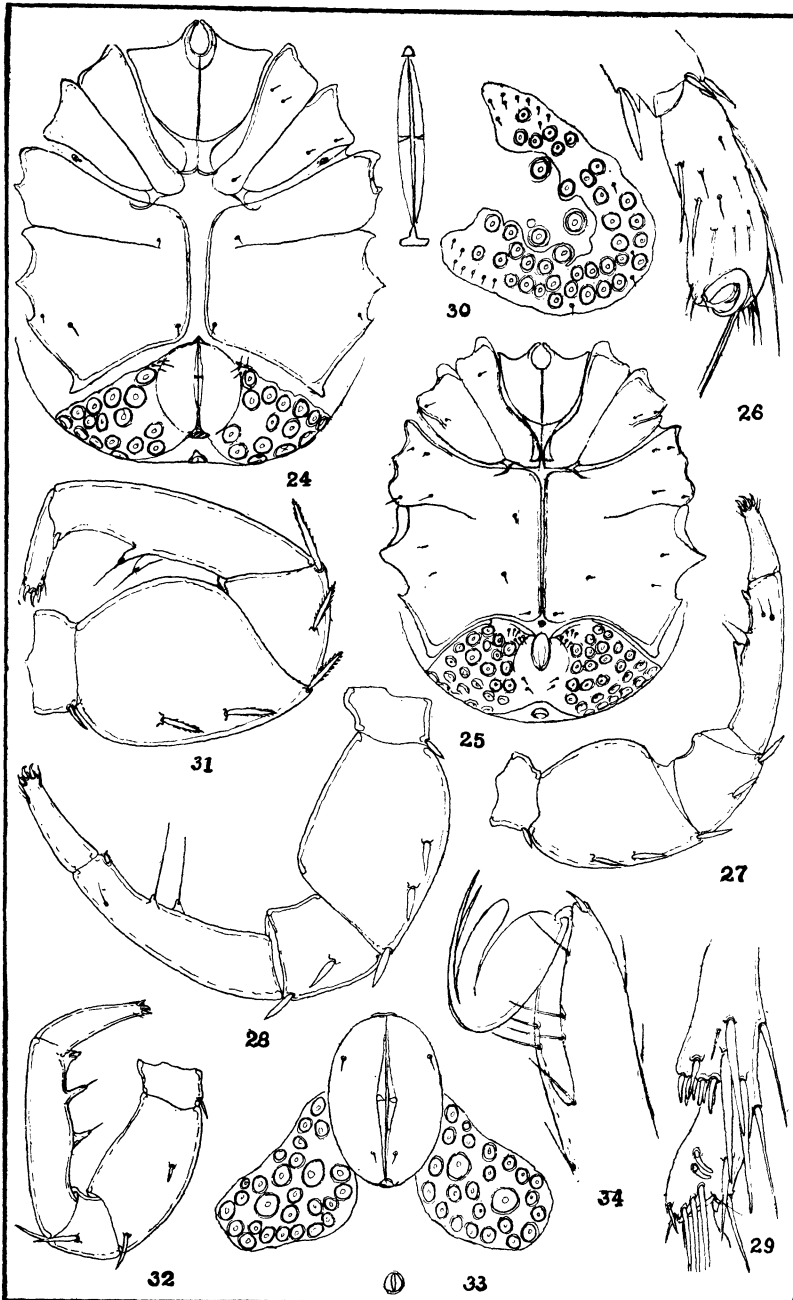
R.H.W. del.

PLATE XXX



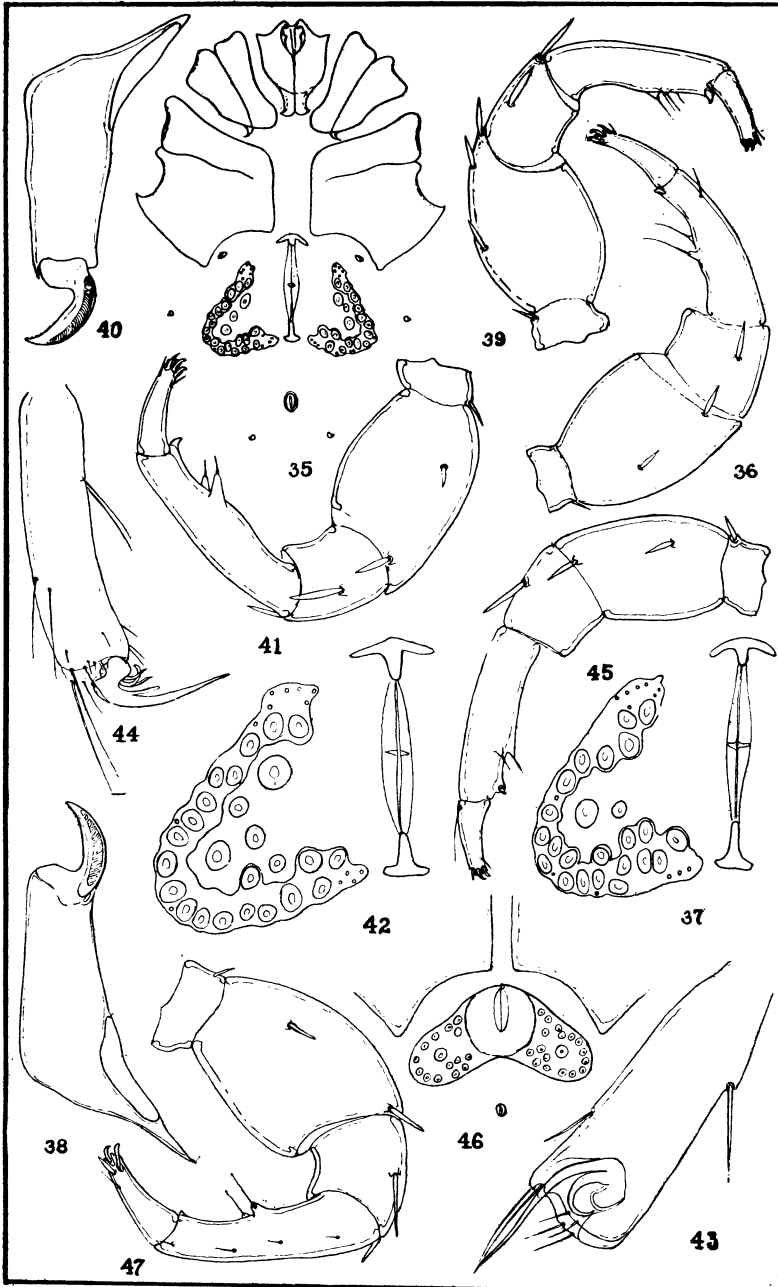
R.H.W. del.

PLATE XXXI



R.H.W. del.

PLATE XXXII



R. H. W. det.

Plate XXXI

Figs. 24-29. *C. spinulosus*

- Fig. 24. Epimeral field and genital area, ♀; $\times 160$.
 Fig. 25. Epimeral field and genital area, ♂; $\times 160$.
 Fig. 26. Segment III 6, ♂, anterior side; $\times 435$.
 Fig. 27. Inner side, right palpus, ♂; $\times 335$.
 Fig. 28. Inner side, left palpus, ♀; $\times 335$.
 Fig. 29. Posterior side, segment IV 4, ♂; $\times 335$.

Figs. 30, 31. *C. medius*

- Fig. 30. Genital area, ♀; $\times 160$.
 Fig. 31. Inner side, right palpus, ♀; $\times 260$.

Figs. 32, 33. *C. triangularis*

- Fig. 32. Outer side, right palpus, ♀; $\times 135$.
 Fig. 33. Genital area, ♀; $\times 135$.

Fig. 34. *C. Reighardi*

- Fig. 34. Claws, tip of segment III 6, ♀; $\times 625$.

Plate XXXII

Figs. 35-38. *C. Reighardi*

- Fig. 35. Epimeral field and genital area, ♀, from High Island Harbor; $\times 110$.
 Fig. 36. Outer side, left palpus, ♀; $\times 260$.
 Fig. 37. Genital area, ♀, from Lake St. Clair; $\times 260$. (cf. fig. 35.)
 Fig. 38. Inner side, left mandible, ♀; $\times 335$.

Fig. 39. *C. obturbans*

- Fig. 39. Inner side, left palpus, ♀; $\times 260$.

Figs. 40-43. *C. rotundus*

- Fig. 40. Inner side, right mandible, ♀; $\times 335$.
 Fig. 41. Outer side, right palpus, ♀; $\times 260$.
 Fig. 42. Genital area, ♀; $\times 335$.
 Fig. 43. Segment III 6, ♂; $\times 625$.

Figs. 44-46. *C. debilis*

- Fig. 44. Segment III 6, ♂; $\times 365$.
 Fig. 45. Outer side, left palpus, ♂; $\times 260$.
 Fig. 46. Genital area, ♂; from an unmounted specimen; $\times 110$.

Fig. 47. *C. inconstans*

- Fig. 47. Outer side, right palpus, ♀; $\times 365$.

Plate XXXIII

Figs. 48-50. *C. inconstans*

- Fig. 48. Genital area, ♀, from Slidell, La.; $\times 260$.
Fig. 49. Epimeral field and genital area, ♀, from New Orleans, La., $\times 100$.
Fig. 50. Genital area, ♀, from Decatur, Neb.; $\times 260$.

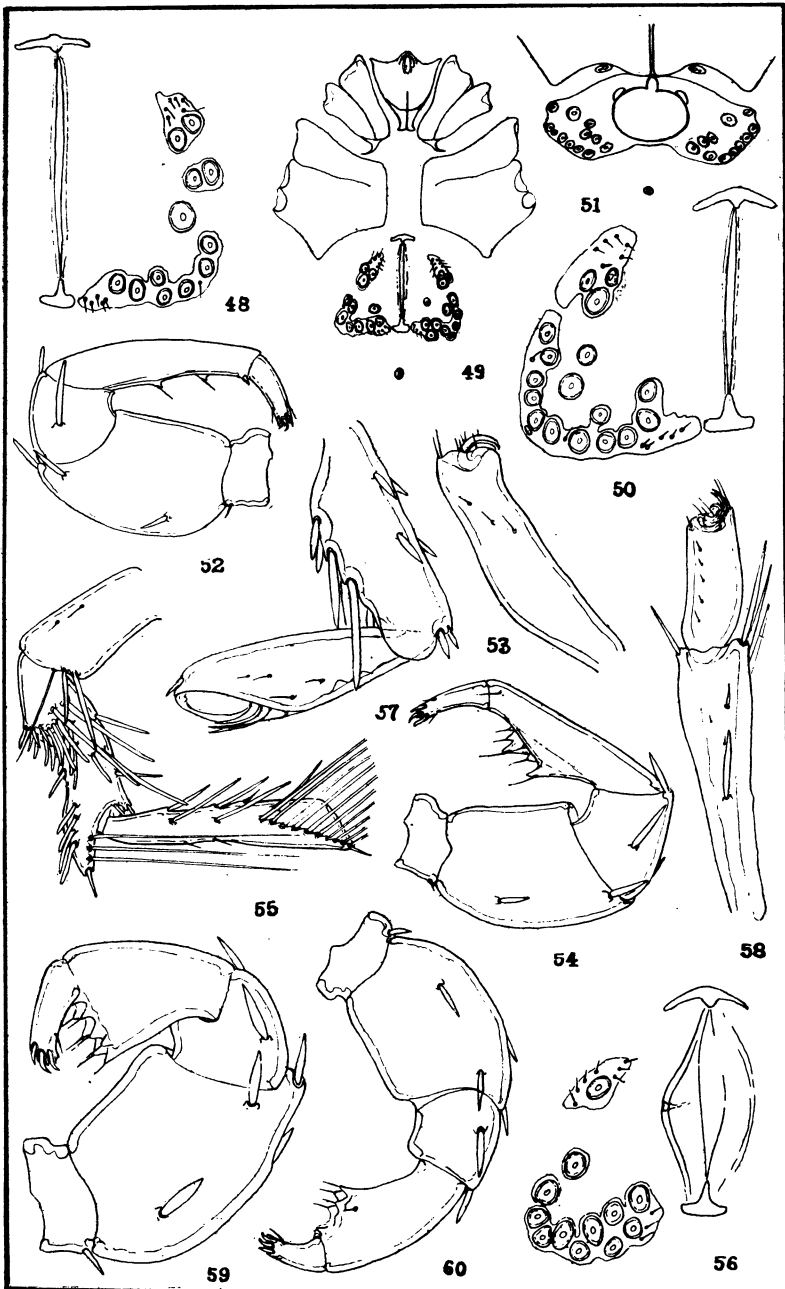
Figs. 51-56. *C. setiger*

- Fig. 51. Genital area, ♂; from the unmounted specimen; $\times 160$.
Fig. 52. Outer side, right palpus, ♀; $\times 260$.
Fig. 53. Segment III 6, ♂; $\times 435$.
Fig. 54. Outer side, left palpus, ♂; $\times 135$.
Fig. 55. Segments IV 3 to IV 5, ♂, posterior side; $\times 260$.
Fig. 56. Genital area, ♀; $\times 260$.

Figs. 57-60. *C. crassus*

- Fig. 57. Segments II 5 and II 6, ♂, anterior side; $\times 335$.
Fig. 58. Segments III 5 and III 6, ♂; $\times 260$.
Fig. 59. Outer side, left palpus, ♂; $\times 335$.
Fig. 60. Outer side, right palpus, ♀; $\times 260$.

PLATE XXXIII



R.H.W. del.